



FRIDAY, APRIL 13, 1900.

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Contributions.

Yellow Signal Lights on Foggy Mornings.

April 9, 1900.

To the Editor of the Railroad Gazette:

I have read the report on tests of red and yellow glasses published in your issue of April 6 and also your comments on the same. In the minds of many men connected with the practical operation of trains and signals there will still remain the impression that your comments, as well as those of Prof. Derr, leave something to be desired. There is one test which I conclude you have not made, and which it is obvious that Prof. Derr, working in a laboratory, could not make. I mean the test of fog and smoke. In the early morning, particularly when it is foggy or smoky, or when we have the peculiar combination of both, which is familiar to everyone, but which it is not easy to describe, there is a time when neither the blade nor the lamp is distinguishable more than two or three hundred feet away; and at this time there is a more decided appearance of red in the yellow glasses than under any other conditions.

Laboratory tests must remain unsatisfactory as long as they do not (and cannot) give us the conditions of actual service. MASSACHUSETTS.

[The worst thing that could be said about the yellow glass would be to assert that it looked precisely like red. Prof. Derr did not ignore this point. He tested the red and the yellow glasses when they were so small or so far away that no one could distinguish the difference between them. For ourselves, as was stated in the discussion of the subject in the Railroad Gazette of Dec. 8 last, we see no fatal objection to a third color, even admitting that it is liable at times to look precisely like red. One of the arguments which was mentioned was the fact that long experience in England has shown that the use of red in distant signals is not dangerous. To make a dangerous error with the yellow an engineman must (1) get past a distant signal without seeing it, so as to come up to a home signal, thinking that that is the distant signal; and (2) he must think the red (home signal) light is so lacking in redness that it is probably a yellow, and so does not require him to stop; and (3) he must be so careless as to act on this probability as though it were a certainty. As we have before intimated, the probability of this combination of circumstances is so small that one might reasonably ignore it without the test of English experience; but with that test the case is practically settled. The surest way to get an engineman past a signal without letting him see it, would be to extinguish the light on a foggy night. The possibility of the failure of a good oil light is quite remote, and yet this danger is probably greater than that due to any confusion of colors likely to occur. To know the exact location of all signals, and to slacken speed, if necessary, when dense fogs prevail, are among the primary essentials of an engineman's training; why should not the signal engineer be allowed to take this fact into his calculations?—Editor Railroad Gazette.]

Locomotive Design.

By E. H. McHenry.*

In the valuable paper contributed by Professor Raymond, entitled "Some Questions of Locomotive Design" [March 30, p. 198], comments are made on the apparent opportunity for improvements in locomotive design as disclosed by a study of a chart of locomotive horse power presented by Mr. E. M. Herr, and some apparent anomalies in the horse-power curves of various engines are also discussed. The writer was collaterally associated with Mr. Herr in these studies and had originally attempted to chart locomotive curves in this manner, with data obtained during a series of dynamometer tests made several years ago. (See section of traction profile published in Railroad Gazette, October 18, 1895.) The data obtained were too incomplete and uncertain to permit satisfactory conclusions, and it was not until the conclusion of further tests by Mr. Herr, in which a great number of indicator cards of different types

tractive power and horse power, regardless of the boiler capacity or efficiency. Mr. Herr was fully cognizant of these factors, and without doubt intended to include "slipping drivers" as one only of the several causes producing the observed results. It will also be noted that the horse-power efficiency falls in some engines when certain speeds are exceeded. This is due to the increasing percentage of cylinder condensation and friction losses inseparable from operation with short cut-offs.

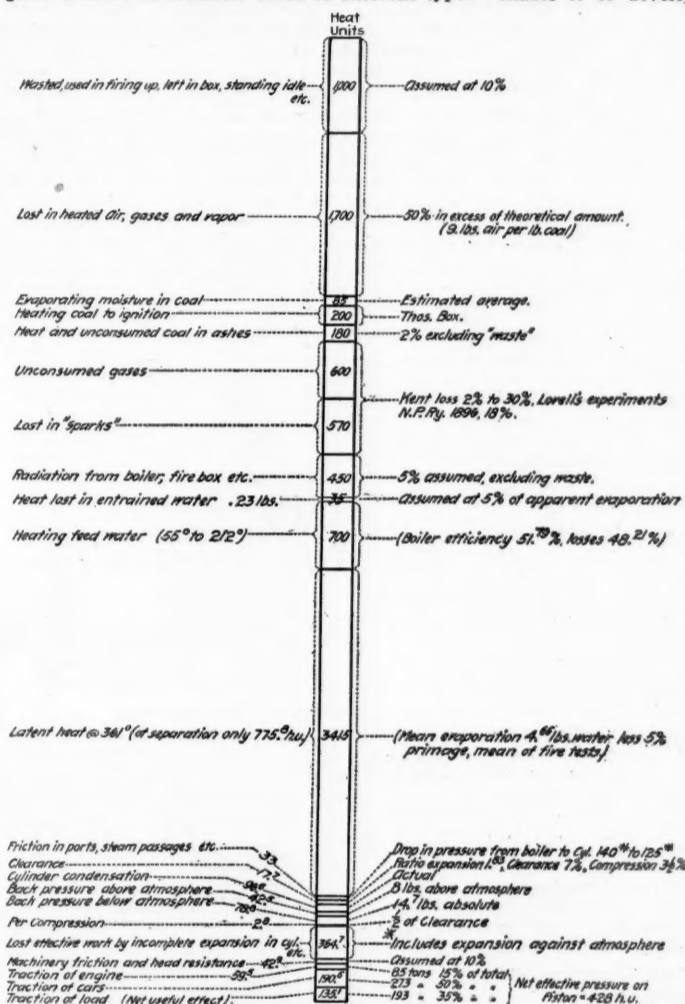
The curve of the consolidation engine Class "F1" shown on the chart [See Railroad Gazette, March 30, page 198] is practically perfect between speeds of 12 and 20 miles per hour, but its cylinder dimensions apparently do not permit the utilization of full adhesion at speeds as low as ten miles an hour.

The curve of the compound mastodon engine Class "X" is equally perfect between speeds of 17 and 25 miles per hour, but in contrast with the consolidation engine its compound cylinders (working simple) enable it to develop 50,000 lbs. traction, which is

surprisingly high as it is equivalent to one-third on the total weight on drivers. This could not ordinarily be obtained, except with the use of sand and could not be attained at all with simple engines, as practical considerations make it undesirable to provide cylinders with tractive power in excess of 25 per cent. adhesion. This invaluable feature of the compound engine is usually overlooked or underestimated.

The curves of the compound engines Class "P" and Class "R" are nearly identical and their uniformity between speeds of 25 and 45 miles per hour is quite remarkable. Class "P" is a passenger engine and is specially well adapted to its particular service. Class "R" is a freight engine, and as it only shows high efficiency at passenger speeds, is very badly adapted for service within ordinary range of freight train speeds. The defective adjustment of the valves probably accounts for the faulty lower part of the curve.

In the later engines built for the Northern Pacific Railway Company, many, if not all, of these defects have been successfully eliminated, and it is quite certain that the opportunities for improvement in engine design are much greater than generally supposed. It is improbable that the specifications furnished to engine builders ever specify the engine horse power desired and very rarely contain any information concerning the



*This item includes errors of assumption as follows: That expansion is hyperbolic, that latent heat of separation is a constant at all temperatures, and that no latent heat (of separation) is transformed into work. The net error probably does not exceed 25 h. u.

Where the Coal Goes When Burned in a Locomotive Firebox.

Heat Losses and net Effective Work of one pound of Red Lodge Coal burned in a typical Mogul engine, in ordinary service—Northern Pacific Ry.

Mogul engine; Class D2; Cyl. 18½ in. by 24 in.; boiler pressure 140 lbs.; cut off 12½ in.; Ind. H. P. 381; speed 16 miles an hour; weight of engine and train 550 tons. Red Lodge coal (by analysis) 10,000 heat units per lb.

11b. coal = 0.168 h. p. hour.
5.95 lbs. coal per h. p. hour.
27.73 lbs. water per h. p. hour.

The motion of the train represents the conversion into work of but
51 per cent. of the theoretically available heat in the steam by a non-condensing engine.
36.2 per cent. of the theoretically available heat in the steam by a condensing engine.
7.4 per cent. of the total heat in the steam.
3.8 per cent. of the total heat in the coal.

of engines under all ordinary conditions of service were obtained, that the compilation of such charts became possible. They were expressly prepared to permit the study of the engines then in the service of the Northern Pacific. Many defects are disclosed, some of which are noted by Professor Raymond.

The loss of horse-power efficiency at low speeds is readily explained, as engines under such conditions usually work with long cut-off or at full stroke. The ratio of expansion under such conditions is much reduced with a consequent loss of efficiency. The generating capacity of the boilers at low speed is usually in excess of the cubic capacity of the cylinders and hence the cylinders cannot develop the full boiler horse power. Defective setting of the valves which throttle admission at low speeds may also reduce the available horse power. Engines are rarely cylindered to use adhesion equivalent to 25 per cent. of the weight on drivers, and at low speeds the cylinder dimensions limit both

physical characteristics of the districts on which such engines are to be operated. Engine builders are usually better able to furnish engines of proper design than their customers are to furnish proper specifications for engines best adapted to the kind of service and the local conditions in and under which they are to be operated. Attempts have been made from time to time to fix a definite relation and proportion between the weight on drivers, cylinder tractive power, heating surface and grate area, but so far as the writer can ascertain, the wide differences in physical operating conditions have never been taken into account.

It would be ordinarily assumed that engines with equal weights on drivers, hauling equal trains at equal speeds and on districts with the same maximum or limiting rates of grade, should be of identical design, but even under these apparently parallel conditions it is quite possible that one of these engines would require a boiler capacity several times in excess of the other. In illustration we will assume the rate of the maximum and limiting grades of two districts at one per cent. (52.8 feet per mile)

*Chief Engineer Northern Pacific Railway.

but in one case this grade is continuous and in the other occurs in the form of a broken or undulating profile, and with the further assumption in the second case that the grades, while too long to be operated by momentum, are not so long as to make it necessary to shut off steam or to use brakes, and that the amount of rise and fall are substantially equal. Under such conditions the average resistance on the first district would be equivalent to the sum of the resistances of the maximum grade and the rolling friction, and both the tractive power and boiler would be continuously taxed to the maximum; while on the second, the average resistance would not differ appreciably from that of a level grade. The maximum tax on cylinders would be developed only on the short sections of maximum grade above momentum limits and the total work done in horsepower hours over the whole division, for which the boiler must furnish steam, would be substantially equivalent to that required by a level grade. To reduce this to figures, it may be stated that an engine with a train weighing 1,000 tons operating a continuous one per cent. grade at a speed of 20 miles per hour must develop 1,440 effective horse power; whereas, on the district of undulating grade, other conditions being the same, but 373.3 average effective horse power is needed. Or differently stated, an engine of 1,000 horse power weighing with train 1,000 tons, would traverse the continuous grade at the rate of 14.4 miles per hour, and the district of undulating grades at the rate of 31.25 miles per hour.

In designing engines for work at highest commercial efficiency under given conditions, the engine builder should know the proposed train weight, the average schedule speed (excluding stops), the ratio of the maximum cylinder tractive power to total weight on drivers and the average and maximum resistance of the engine district. The first three items are fixed arbitrarily. The average horse power required would then be the product of the average resistance over the district into the speed, divided by the constant 375, and the weight on drivers should at least equal the sum of the resistance of the limiting grade and rolling friction at specified minimum speed, divided by the adopted ratio of cylinder traction to total weight on drivers. This is a very simple problem, as all the elements are available in ordinary practice, with the exception of the average resistance of the district, which may be readily determined.

In the determination of horse-power requirements, the average instead of the maximum resistance is used for the reason that an engine can always increase its tractive effort by reducing speed on maximum grades and the boiler also may be forced to a much higher rate during short intervals of time than that which it is possible to continuously maintain. If the ascending grades are unduly long, the schedule will be correspondingly affected, and if steam is shut off or brakes applied on descending grades, it is better to omit such sections from the calculation, substituting an arbitrary schedule.

Internal resistances in the engine usually vary between 5 and 15 per cent. of the indicated horse power and probably average about 10 per cent. Such resistance, however, is the sum of many factors and is constant neither in amount nor percentage at different rates of speed. An inspection of the actual horse-power curves, as shown on the chart, leads to the conclusion that it will be very difficult to devise a practical working formula, and lines derived from actual tests should preferably be used.

As shown by the accompanying chart, the efficiency of the ordinary locomotive engine is low at best, in striking contrast with the theoretical potential energy in the fuel, and it becomes very important to use the available power to the best advantage. This chart was compiled from actual tests of a mogul engine on the Yellowstone Division of the Northern Pacific Railway, in which the coal was weighed and the water measured, frequent indicator cards taken and the final net effective traction at the periphery of the drivers determined by a dynamometer, thus affording an opportunity of checking the calculations at several points in the length of the column, with the effect of localizing minor errors. The efficiency of some modern engines is considerably higher than that shown, but the chart will closely apply to the great majority of the engines in present service all over the United States.

A study of the chart would disclose great apparent opportunities for the improvement of such engines, particularly as a large percentage of the wastes, which are apparently unavoidable, may, theoretically at least, be applied to the reduction of such wastes in succeeding cycles.

Pneumatic Interlocking at the Grand Central.

The Standard Railroad Signal Co. of Troy, N. Y., has taken the contract for a large interlocking plant for the Grand Central Station, New York City. The machine will be of the low-pressure pneumatic type, like that which has been in use at Buffalo for several years, and a new tower will be put up, about 100 ft. north of tower No. 1, to take the place of

both No. 1 and the Forty-ninth Street tower. The new machine will have about 180 "levers," taking the place of 175 mechanical levers in tower No. 1 and 60 in the Forty-ninth Street cabin. Considerable changes are to be made in the location and arrangement of tracks in the yard, and the work is to be begun within a few weeks.

The low-pressure pneumatic machine which has been put in by the Standard Company for the Erie Railroad at Grove Street, Jersey City, was put into operation on April 1. This company is about to install pneumatic machines for the Chicago Terminal Transfer Railroad at Polk Street, Chicago; for the Chicago & Western Indiana, at Sixteenth and Clark Streets, Chicago, and for the New York Central & Hudson River at Suspension Bridge, N. Y., and Hoffman's, N. Y. These machines aggregate about 368 levers.

Automatic Semaphore Block Signals on the Lackawanna.

The Union Switch & Signal Co. of Swissvale, Pa., has contracted to equip about 40 miles of the line of the Delaware, Lackawanna & Western with automatic block signals, and the work is to begin at once. The portion of the road to be signaled is about 40 miles, all double track. From Little Falls, N. J., to Dover, about 21 miles, there will be a single semaphore signal for each block; from Dover to Hackensack, about 19 miles, there will be a distant as well as a home signal for each block, two arms being placed on each post, as is customary in electro-pneumatic signaling. The signals are the Union electric semaphore, worked by electric motors, and controlled by track circuits. The posts are wrought-iron tubes set on concrete foundations, and the blades are of

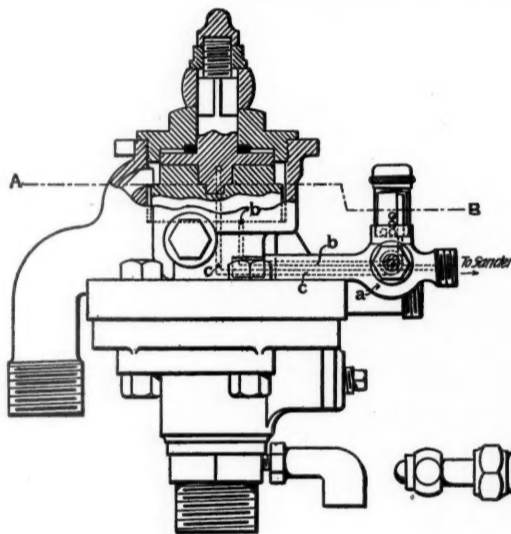


Fig. 1.

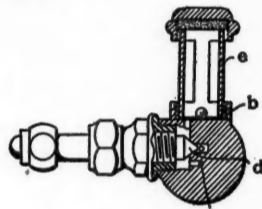


Fig. 4.

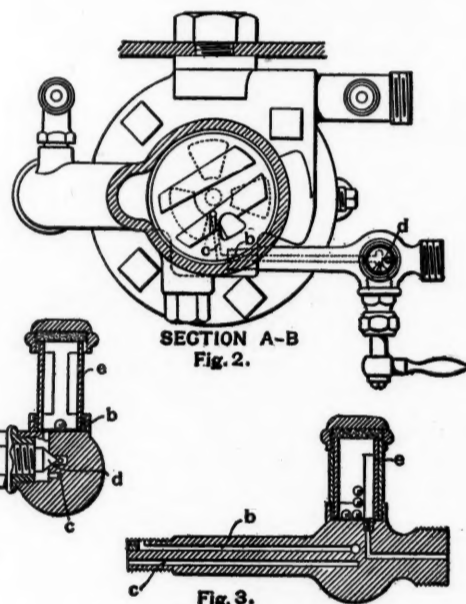
SECTION A-B
Fig. 2.

Fig. 3.

Sherburne's Brake Valve Attachment for Operating Pneumatic Sanders.

wood. The electric motor is in an iron box at the foot of the post, and the rod actuating the signal is inside of the post. The signals are to stand normally at stop, or danger, and the distant signals will be controlled by the track circuits without the use of line wires, this being effected by means of polarized relays, such as are in use on the New York Division of the Pennsylvania. The arrangement by which this relay is used was described in the Railroad Gazette of March 30, page 205. A single motor answers for both the home and the distant arms.

The spectacle castings for these semaphores will be arranged to carry two glasses, so that it will be easy to adopt green for all clear whenever that shall be deemed desirable. Gravity batteries will be used for the rail circuits, and these will be placed in cast-iron shutles. For the motors, Edison-Lalande batteries, 300 ampere-hour, will be used. These batteries will be kept above ground, in sheet-iron boxes.

On the portion of the road to be equipped there are half a dozen interlocking towers. In these there will be bells and indicators showing the condition of the track, whether occupied or unoccupied, in the section in which the tower is located, and also all necessary indications for adjoining sections. At switches there will be boxes to shunt the track circuit in two places.

The signals now to be put in are included in a scheme by which the main line of the Lackawanna will have automatic signals from the terminus at Hoboken through to Hackettstown, 57 miles. From Paterson westward to the point where the new semaphores will begin, automatic disk signals were put in a few weeks ago. From Paterson eastward to Hoboken, about 15 miles, signals will probably be put in within a few months. A considerable length of the Morris & Essex Division, from Hoboken through Newark and Orange, has been equipped with Hall automatic disk signals for several years.

Sherburne's Brake Valve Attachment for Operating Pneumatic Sanders.

Mr. C. W. Sherburne, of the Automatic Track Sanding Company, Boston, has recently been granted patents for a simple attachment to the engineer's air brake valve whereby any pneumatic sanding device can be operated by the movement of the handle of the engineer's brake valve during an emergency application; or, by varying the dimensions of one port, this automatic working of the sander may be made to take place during both service and emergency stops. The automatic feature, however, does not interfere with working the sander in the usual way by hand when the brakes are not operated. Further, the air for working the sanding device passes through a short feed glass indicating to the engineman, by the agitation of small balls within, whether air is passing and something as to its velocity. This indicator comes into play whether the sander is worked by hand or in connection with the brake valve. Mr. Sherburne's new attachment is approved by the Westinghouse Air Brake Company, and that company hereafter when requested will furnish brake valves having the necessary additional ports.

The principal features of this device are apparent from the accompanying engravings showing the application to the Westinghouse apparatus. Fig. 1 is the engineer's valve, the only changes being a hole tapped into the casing for the attachment a, and the two ports b and c. Port b, as shown in Fig. 2, terminates at the valve seat beyond the face of the rotary valve, and is always open to the air chamber above the valve so that there is air under pressure in this port at all times up to the conical

valve d. When the hand valve d is open, air goes to the sanding device and the working of this valve furnishes an independent means for operating the sander. The port c is in no way affected by the valve d, and it will be seen that it extends up through the rotary valve to the air chamber above, the opening and closing of this port being controlled by the movement of the handle of the engineer's brake valve. Plainly, the length of the port in the valve seat and the relative positions of the openings in the seat and the face of the rotary valve determine whether air is admitted to port c, and thence to the sander, during both service and emergency stops, or during emergency stops only.

The indicator to show the engineman whether air is passing to the sander is given in Figs. 3 and 4, which are sections through the attachment. This consists of a short piece of glass tubing, e, with suitable packing, within which are a number of small balls. The air from port c, and in the same way from port b when the valve d is open, enters the indicator at the bottom, while the exit is through a tube extending nearly to the top of the indicator; the lower end of this tube connects directly with the air passage to the sander. Air in going to the sander must pass through the indicator and agitate the balls, making it apparent at once if any part of the apparatus is out of order.

The whole arrangement is a very simple one for accomplishing the double purpose of applying the brakes and sanding the track with one movement on the part of the engineman.

Sayre Shops of the Lehigh Valley.

Among the improvements of the Lehigh Valley the additions to the shops at Sayre, Pa., are worthy of note. The erecting shop has been extended 147 ft., which enlarges the capacity by six pits, with a cor-

responding increase on the machine side, so that now seventeen engines can be handled at the same time. In connection with these shops has been installed an electric transfer table for shifting engines in and out of shops. This is operated by a 50 horse-power motor, which also serves for hauling the locomotives on and off the table. Also on the machine side of the shop are three drop tables, and there have been added to the equipment a driving-wheel lathe, 90-in. swing, a screw machine, a turret lathe, an engine lathe, 36-in. swing; a 42-in. by 42-in. planer and a boring mill, 51-in. swing.

The flue shop and boiler shop have been joined, and fitted with two flue-welding machines.

The new power-house contains the boilers, and all of the electrical generating apparatus. In the engine room are one stationary horizontal engine; also one 50 kw. power dynamo, two 25 kw. incandescent dynamos, one 10 kw. incandescent dynamo, and two arc machines, 75 lights each. The switchboard is arranged so that when the lights are not required, one or both of the 25 kw. machines can be switched over to the power circuit.

The dynamos are all direct connected, with the exception of the arc-light machines, and are driven by Harrisburg high-speed engines. The pump room contains the boiler-feed apparatus and feed-water heaters; also one Ingersoll-Sargeant independent air compressor, having a capacity of 600 cu. ft. of free air per minute, and the engine used in connection with forced draft for the boilers.

The boiler room contains Babcock & Wilcox water-tube boilers, with a generating capacity of 1,250 h. p. These boilers have forced draft with low stack, and there is space left for an additional 250 h. p. should it be needed later.

The new blacksmith shop is 75 ft. x 200 ft., and contains 32 fires, and is fitted with the Buffalo Forge Company's system of underground blast and exhaust.

The new paint shop is brick, with saw-toothed roof. The building contains 12 tracks, with a capacity of 36 cars. It is heated and ventilated with hot air by the Buffalo Forge Company's system, and is supplied with 33 arc and 144 incandescent lights, the latter so supported by adjustable fixtures as to be moved in any direction.

The passenger car repair shop has a capacity of 14 cars. The freight car repair shop has a capacity of 33 cars.

Fast Run on the Atchison.

We published last week, page 221, an unofficial account of a fast run by a special train over the Atchison, Topeka & Santa Fe on March 27-29, with a profile of that portion of the road over the mountains of New Mexico. After the paper went to press we received the official record of this run, and we print herewith a revised table to correct certain errors. At two places in Kansas the train appears to have travelled over a line shorter than the main line, and therefore the distance, as first published, was wrong. The average rate of speed through, including all stops, was 38.55 miles an hour instead of 39 miles, as first given. Deducting stops, the rate through was 41.71. The engines used on the mountain section were Baldwins with 20 in. x 26 in. cyl-

man in the tower, and the tracks from the westbound yard to the home signal, just east of the tower, are operated as a part of the yard. The calling-on signal was put in to give the man in the tower a quick and convenient means of indicating which one of two or

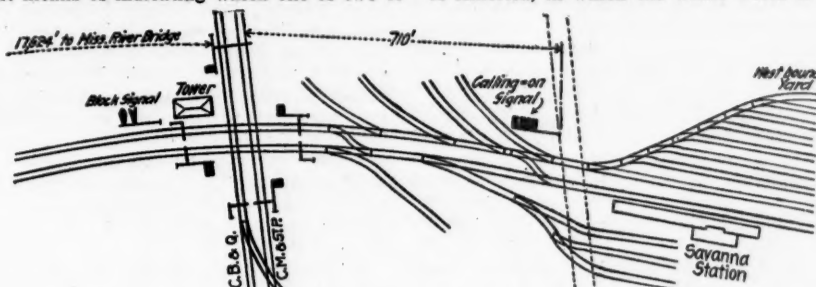


Fig. 1.—Signals at Savanna, Ill.—C. M. & St. P. Ry.

more trains he desires to send forward. The arms are painted yellow (different from the standard signal arm of the road) and when in the horizontal position they show, at night, a yellow light. When the signal is cleared a white light is shown. The upper arm is used to call on passenger trains for the Council Bluffs line; the second arm for Dubuque passenger trains; the third arm for Council Bluffs freights and the fourth arm for Dubuque freights.

The yardmaster's office is at the farther (east) end of the yard. When a conductor at this office is ready to start his train he notifies the towerman by telephone and then proceeds to his train. If the

Would you destroy it? If so, fire away and let the charge pass through my body." The gun was not fired; and the Patent Office was saved. As the nineteenth century, then young, draws to a close, that office is again threatened. The plea then made to a foreign foe prevailed. Will our own people prove less responsive now?

The phenomenal growth of the American patent system, alike a source of pride to us and of admiration to the whole world, has resulted in the accumulation of an appalling mass of important records and documents at the Patent Office which taxes its storage capacity to the utmost and seriously embarrasses its

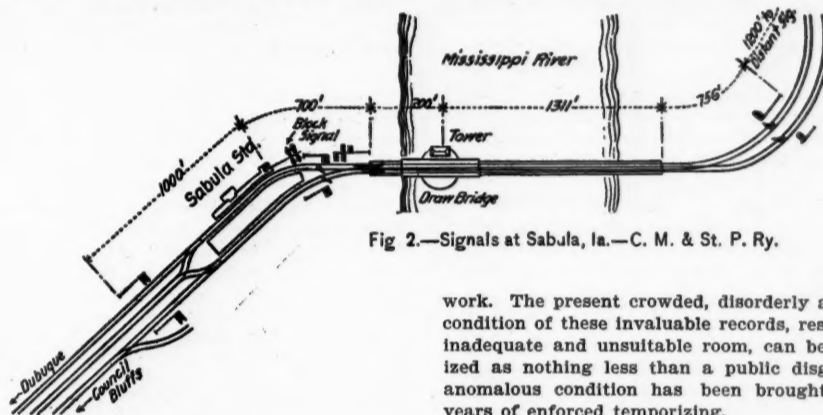


Fig. 2.—Signals at Sabula, Ia.—C. M. & St. P. Ry.

towerman is ready to send that train forward the conductor finds the calling-on arm down as soon as he is able to reach the train and give the go-ahead signal to his engineman.

The lower arm on the block signal post west of the tower is for permissive signaling and is controlled electrically by the signalman at Sabula, west of the river.

We understand that the experience of the officers of the Milwaukee road with the yellow glass at this

work. The present crowded, disorderly and exposed condition of these invaluable records, resulting from inadequate and unsuitable room, can be characterized as nothing less than a public disgrace. This anomalous condition has been brought about by years of enforced temporizing.

The erection of the present Patent Office building was begun shortly before the fire of December 15, 1836, which destroyed the quarters then occupied by the Patent Office, as well as all its models and records. This building, as finally completed, is in the form of a hollow square inclosing an open court. That portion or "wing" of the building at the south side of this court was first built, it being completed in 1840. About this time the erection of the east wing was begun; but it was not completed until 1852. The funds of the Patent Office, which were kept separate from the general funds of the Government from 1836 to 1868, were drawn upon in the erection of each of these wings, about \$160,000 being appropriated therefrom for the erection of the south wing alone.

The Patent Office was originally nominally under the supervision of the Secretary of State; but upon the creation of the Department of the Interior, in 1849, the Patent Office was made a bureau of that department. The State Department had proven very indulgent toward her sturdy offspring, the Patent Office having been for a long time practically free of all control from that quarter. With the advent of the young stepmother, however, this condition was changed. She at once signified her intention to make her home under the same roof with the Patent Office; and she forthwith appropriated for that purpose the newly built east wing. This wing, having been erected at the solicitation of the Patent Office, and to no small extent with appropriations from its funds, was naturally looked upon as intended for the use of that office; but the young foster mother ruled otherwise. She came; and she brought her family, including the Land Office, the Office of Indian Affairs, and later, the Office of the Commissioner of Railroads. Indeed, she took supervisory charge of the whole building, the west and north wings being meanwhile completed; the former in 1856 and the latter in 1869. Thenceforward the Patent Office was destined to have its space boundaries ultimately determined by some official outside its folds, and, not infrequently, ignorant, if not indifferent as to its needs, its demands for room being consequently often met, not in accordance with its own requirements, but in conformity to those of some other bureau.

Of course, the household of each member of the family grew. Each accordingly demanded more room. That there were resulting domestic discords, however, is more readily imagined than proven. If they existed, they were kept well within the family circle; and it would now be uncharitable to attempt

SPECIAL TRAIN OVER ATCHISON, TOPEKA & SANTA FE RAILWAY. MARCH 27, 28, 29, 1900.

		Distances, Miles.		Time.		Time Standard.	H. M.	Speed, M. P. H.	Net Speed M. P. H.
Los Angeles,	dep.	0	0	Mar. 27	10:00 a. m.	Pacific	3:55	36.00	37.60
Barstow,	arr.	141	141	" "	1:55 p. m.	"	4:30	37.55	38.55
Needles,	dep.	0	310	" "	2:05 "	"	4:07	36.19	
Seligman,	arr.	149	459	" "	6:35 "	"	5:10	37.67	
Winslow,	dep.	0	602	" "	8:43 "	"	6:37	43.22	
Albuquerque,	arr.	148	888	" "	10:50 "	"	10:58	31.64	34.57
La Junta,	dep.	0	1235	" "	11:55 a. m.	"	3:37	55.85	57.12
Dodge City,	arr.	347	1437	" "	5:50 "	"	4:19	52.35	55.80
Emporia,	dep.	0	1684	" "	12:27 p. m.	"	3:08	35.41	39.51
Argentine,	arr.	202	1773	" "	11:58 "	"	9:57	45.70	49.98
Chicago,	dep.	227	2236	" "	3:22 a. m.	Central			
	arr.	463		" "	8:49 "	"			
	dep.	0		" "	8:55 "	"			
	arr.	109		" "	12:03 "	"			
	dep.	0		" "	10:00 "	"			

Time, through, 58 hours. The total time consumed in stops was four hours, 23 minutes.

inders. On the grades west of Winslow, Ariz., Dickson engines, with 19½ in. x 26 in. cylinders, were used. The train consisted of two cars, weighing 148,900 lbs.

Calling-on Signals at Savanna, Ill.

A calling-on signal, which is in use on the Chicago, Milwaukee & St. Paul at Savanna, Ill., was mentioned in a discussion at a recent meeting of the Railway Signaling Club. The engraving printed herewith shows how this signal is used. Savanna is about three miles east of the Mississippi River. Trains are made up here to cross the river and to proceed, after crossing, by either one of two lines, that to Council Bluffs or that to Dubuque. The calling-on signal, which has four arms, is neither an interlocking nor a block signal. The block section westward from the tower (shown in Fig. 1) to the drawbridge, three miles, is controlled by the signal-

signal has led them to form favorable opinions of the color for use in distant signals.

The block section from Savanna westward to Sabula is that on which for several years the Webb & Thompson electric staff was used. The line is now double track, except over the bridge, and the staff apparatus has been taken away and put in service between Rockton and Beloit, on the Racine & Southwestern Division, where there is a complicated train movement.

The Need of a New Building for the United States Patent Office.

By George L. Morton, M. E.,
Principal Examiner, U. S. Patent Office.

While the City of Washington was occupied by the English in 1814, they were about to discharge a cannon trained upon the building in which was located the Patent Office of that day, when William Thorne-

to lift the well-drawn veil to expose any infelicity. Certain it is that in these rivalries the Patent Office seemed to wage an unequal contest; as may be judged from the conditions pictured in the report of the Commissioner for 1879, in which it was said: "This Bureau is now restricted to a small part, which is also the worst part of the building, the best portion being occupied by the Land Office, the Indian Bureau, the Assistant Attorney-General, and the Office of the Secretary of the Interior."

The law of 1836, which authorized the building of the Patent Office, made it imperative that a model be furnished in all cases where the invention admitted of representation by model. The operation of this law for fifty years resulted in such an immense accumulation of specimens and models that they literally filled the four vast halls provided for their reception, each of which included the entire upper floor of a wing of the building.

The number of these models had reached nearly 200,000, when on September 24, 1877, 120,000 of them were destroyed by fire which swept through the north and west halls. In order to check the accumulation, a law had been passed in 1870, providing that models should not be accepted unless required by the Commissioner. This law operated in time to bring about the result sought. Notwithstanding, there are at present 150,000 models and specimens constituting important public records, which, as such, must be preserved. They are, besides, of great scientific and historic value. Nevertheless, more than half of these models have been removed from the halls originally intended for them to a rented building outside, the Patent Office being required to share the space thus vacated with other bureaus of the Department.

Prior to 1869, patent drawings were copied by the expensive and laborious process of tracing. In that year the Office began making copies by silver-print photography; but the year following, this process was supplanted by that of photolithography. In order to produce copies cheaply by the latter process, it is necessary to print a large number at a time. This number has ranged by successive reductions, from 300 at first, down to 75 at present. When a patent issues, the predetermined number of copies of each sheet of the drawings is made. To these is attached a like number of printed copies of the specifications of that patent, the whole constituting a package having a standard width and length of 8 and 11½ inches, respectively. These packages range in thickness from ¼ inch up to 2 feet as a maximum, a tolerably fair average being about 7/16 inch. Based on this average, a rough idea of the growth and volume of these copies may be gained by considering the aggregate thickness (1) of the packages comprising the average weekly output for last year, which is about 30 feet; and (2) of those representing all the patents thus reproduced, which is in the neighborhood of 70 miles. The proper storage of these bulky copies has proven a source of the greatest embarrassment. It was not realized in the beginning to what immense proportions they were destined to grow. The building having been completed before their production was begun, they were not contemplated in its original design. Consequently, no suitable or adequate room had been provided for them. Hence they have been stored piecemeal here and there in odd corners throughout nearly the entire building. When the particular space last relied upon became crammed to its utmost, the one next to be secured would perhaps prove to be a block or more away, or on an entirely different floor. With such enforced temporizing, all efforts at constructive or systematic arrangement were without avail. On all hands these dust-laden and unsightly records obtrude themselves, lurking in the dark alcoves and passageways of the basement, obstructing the corridors of the first floor, and converting the otherwise beautiful model halls into vast lumber rooms and tinder boxes. The inflammable and exposed condition of these copies, wherever they are, render them a constant menace to everything in their vicinity.

Furnished at a mere pittance, they are in great demand from all quarters of the world. To meet this, a large force is kept constantly employed in making selections from the mass. As may readily be imagined, this work is greatly hampered and delayed by the scattered and disorderly condition of the stock. As was said by the present Commissioner in his report for 1898, "Were room provided for the convenient and accessible storage of these copies, a force smaller than that now employed would be sufficient to promptly fill all orders."

These printed specifications and drawings, which represent final results appearing in Letters Patent, valuable as they are, are nevertheless copies; and, if once destroyed, they might, at great expense and labor, be reproduced. This is not true, however, of original records. Back of every patent is a file of documents disclosing the basic application and the complete history of its prosecution to ultimate grant. These documents are of vast importance in fixing the scope and consequent value of the patent. They operate sometimes in favor of the patentee, to give

the patent a broader aspect than it would have upon its face; more frequently in favor of the public, to restrict the scope of the patent; and always in the interests of justice to both public and patentee. The safe preservation of those application files which have matured into Letters Patent is therefore a matter of the greatest public importance; especially, since, if once destroyed, they could, with rare exceptions, never be replaced. Yet these records are stored in one of the immense model halls in close proximity to the largest and most crowded accumulation of the printed copies, above referred to, in the whole office; and while the files have been isolated, so far as these anomalous surroundings would permit, they are still constantly menaced by reason of this close proximity of the more exposed and combustible printed copies.

It is provided by law that an assignment or conveyance of a property interest in Letters Patent, to be effective against all subsequent purchasers, must be recorded in the Patent Office. As a result of this requirement, hundreds of volumes of assignment records have been gradually accumulated. These serve to give public notice as to the ownership of untold millions of dollars' worth of property in patents. Because of this fact, they are resorted to by people from all parts of the country for information relative to this important matter. These volumes constitute the only means by which many vexed questions of title to patent property may be settled.

The present Commissioner of Patents, in his report for July 15, 1899, referring to these application and assignment records, said: "In view of the fact that millions of dollars in property would be jeopardized by the destruction of our assignment records—many of the original assignments having been lost by their owners, who depend upon duly certified copies—and in view of the fact that many of our other records are largely of a nature that money could not replace, I believe a fireproof structure should be provided in which to store them." Again, in his last report, he repeated this recommendation and said of these records: "Their loss would work an incalculable injury, not alone to the owners of the patents, but the public in general." At present the assignment records are, like the application files, stored in one of the large but overcrowded model halls. Appreciating the practical importance of these records, and seeing their present exposed condition, the American Society of Mechanical Engineers in resolutions passed at its meeting in Washington last spring urged "that the records of the Office which so largely constitute the legal evidence of title of so many of the large manufacturing industries of the country, should be more safely stored, and that ample appropriations be made for providing incombustible receptacles for the records."

Besides the files and drawings of the applications which have matured into patents, there is an immense number upon which patents have not been granted, and also many caveat files, the whole aggregating the enormous total of about 1,220,000 files, and nearly that number of drawings. The abandoned application and caveat files, which constitute 43 per cent. of these, are to be found stored here and there in obscure alcoves and corners on every floor of the building.

Not only are the documents of the Office thus widely and irregularly distributed, but the working rooms assigned to it, contrary to what would naturally be expected, are also scattered about in different parts of the building, interspersed with rooms of other bureaus of the Department. There are 37 examining divisions; of these 19 occupy rooms distributed about portions of the lower floor, where, in several cases, the two rooms occupied by a single division are not adjacent, and in two of these cases the rooms are a whole block apart. Five examining divisions have rooms on the second floor, one of these also having a room on the first floor, while the remaining 19 occupy rooms formed by erecting partitions in three of the original model halls of the upper floor. Of the four so-called clerical divisions, one only, the Assignment Division, has a single large room, a part of one of the original model halls; another occupies rooms on the first floor and in the basement; a third has working rooms on all floors save that of the basement; while the fourth occupies rooms on every floor, excluding the first and including the basement. Inadequate provision was made for the examining division last to be formed and for the important newly created Classification Division by crowding together the 60 or more people in the Assignment Division above mentioned, all three divisions being thus huddled into a space barely sufficient to accommodate that one. Besides being crowded in all cases, many of the working rooms of the office are fit only for storage purposes, being either badly ventilated or so poorly lighted that gas must be kept burning even during the brightest days.

From this review it will be apparent how greatly the Patent Office is hampered in its present unfavorable condition. It is crowded on all sides and constrained to work under the most adverse cir-

cumstances. The opportunity for limited expansion in prospect will afford but temporary relief.

As a result of careful measurements and computations, it is estimated by Chief Clerk Shepard of the Patent Office that if the entire building were turned over to that office, its models and records all properly stored therein, and the divisions adequately provided for, present needs would be barely met. The Patent Office is nearing a crisis in its phenomenally rapid development at which a new fireproof building, specially designed to meet modern requirements and future growth, becomes an imperative necessity. The time-serving policy of the past can be continued but a few years longer.

The Patent Office of this country is already the largest institution of the kind in the world, and it is still growing day by day. From the foundation of our present system up to January 1, 1900, we had granted 693,979 patents, which is more than half as many as had been issued, prior to 1899, by the whole patent-granting world outside this country.

We, in the year 1899, issued 25,527 patents, which is equivalent to 70 each day of the year, and, to one for each 2,977 of the country's inhabitants. Comparing this with the past record of the Office, and it appears that the output for last year exceeded the total patents issued from the establishment of our system down to the year 1856, and was twice that of a year so late as 1873. If we compare the number issued by this country in 1899 with those of foreign countries for the preceding year—reliable figures for a later period being still forthcoming—the result proves equally flattering to our system. Our output last year exceeded those for 1898 of Great Britain and France combined—these countries ranking, in this particular, next to ours in the order named—and was more than twice those of any other two foreign countries united.

The Patent Office has not only to do with patents, but it is also charged with the registration of trade marks, and of prints and labels. This constitutes an important branch of its work; as may be realized from the fact that the total of these registrations—none of which began before 1870—had at the close of last year reached 41,422, which is equivalent to nearly 6 per cent. of the total patents granted. This line of work is also growing; the registrations last year, which were 2,260, being over 400 in excess of those of any other year.

The Patent Office added to the general funds of the Government by its receipts last year, \$1,325,457, or an average of \$3,660 for every day in the year. Its receipts thus constituted 3.7 per cent. of the entire so-called miscellaneous receipts of the Government for the year. It is more than self-supporting, its total receipts exceeding the total expenditures on its behalf, including the appropriations from its funds for the erection of the present building, by the enormous total of \$5,087,000; a sum more than ample for the erection of a new building.

With such a brilliant record behind it, we may speak with tolerable assurance as to the future of the United States Patent Office. The nineteenth is pre-eminently the century of invention; but it has not exhausted the field. He would be bold indeed who, in the light of the past, would attempt to fix bounds to the inventive genius of the future. Its opportunities are as limitless as is the realm of things unknown. The enlargement of the sphere of knowledge simply opens new avenues to this unexplored region. Inventions will, therefore, be made so long as they meet human needs, and they will be patented until patents cease to be of value. Not before this very remote possibility threatens will the successive yearly issues of patents cease to grow. If we assume, however, that the average annual output by this country for the next 27 years will only equal that for the year just ended, the grand total, from the foundation of the system to the end of that period, would be double what it is at present. But since, as above pointed out, the issue of last year was twice the annual issue of 27 years ago, it is fair to assume, at least, that the average rate of increase for the past 50 years will be maintained for a score of years to come. Based upon that assumption, the total of to-day would be doubled at the close of the year 1920. To attain this result, the issue that year would, with uniform growth, need be but little above 38,000, or 50 per cent. more than that of last year, which everyone acquainted with the facts will recognize as far within the range of probability. The total registrations of trade marks, prints, and labels combined will have doubled in less than twenty years. It is therefore fair to assume that, at the close of the year 1920, all the records of the Office—with the single exception of models, which now receive few additions—will be double what they are to-day. Twice as much space will therefore be required for storage. Not only this, the working force of the Office at that time will need to be fully double what it is now; because, while it is here conservatively assumed that the annual output of patents will then be but 50 per cent. greater than at present, the field of search necessary to be covered in the examination of each of these will be nearly twice what it is now. The work involved in

the examination of the total applications for the year 1920 would therefore be nearly three times that involved in the examination of those for last year. Besides, classification, which is the great prerequisite to our system of examinations, becomes of relatively much greater importance as the patents and publications increase. The care and labor involved in this branch of work must therefore increase even more rapidly than the matter to be classified. It is consequently well within the bounds of truth to affirm that, if the entire present building, could it be made available for that purpose, would hardly suffice to properly meet present needs of the Office, a building twice the size of that one, if in other respects no better suited to the requirements of the Office, would be utilized in full by the close of the year 1920. As a matter of fact, however, the Office is now restricted to areas which together comprise only about 60 per cent. of those of the entire building; and there is little prospect of any material increase in this allotment. Even if given the entire building, the invaluable records of the Office could not be stored therein without great danger from fire; and there would be practically no room for expansion in future growth, except by again resorting to the process of crowding, with its consequent disarrangement of records and embarrassment to work. To give the Office the entire building now as a measure of permanent relief, would be simply to provide a more pretentious stage for the final act in that already long drama of time-serving, which, with a less serious subject, might be looked upon as a comedy, if it did not threaten to finally end in tragedy.

Crowded and hampered now, what will be the condition of the Patent Office twenty-one years hence, when its force and records have doubled? or even at the end of ten years, when its space requirements are fully a third greater than at present? The erection of a new building, suited to the modern requirements of the Office, would perhaps consume a whole decade. It was eleven years after the first appropriation for that purpose, before the building of the new Congressional Library was completed.

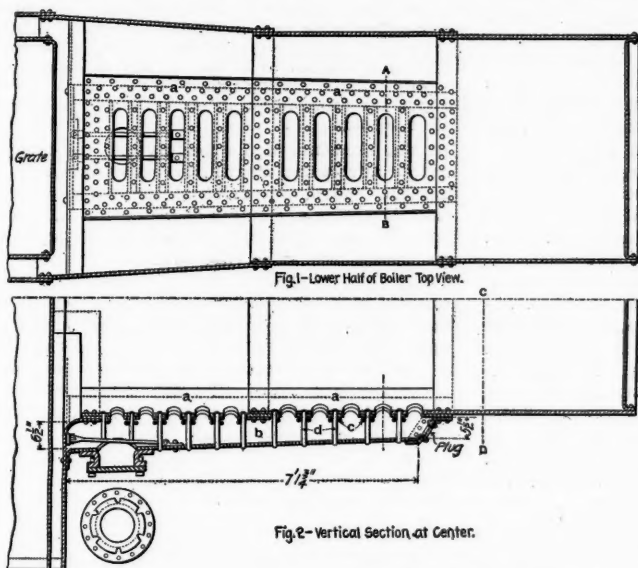


Fig. 1—Lower Half of Boiler Top View.

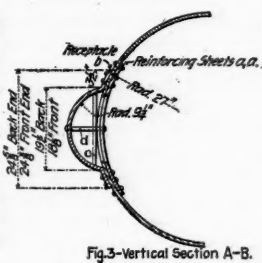


Fig. 3—Vertical Section A-B.

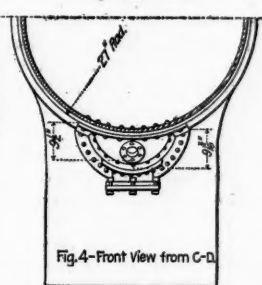


Fig. 4—Front View from C-D.

Fig. 2—Vertical Section at Center.

The Haskell Mud Drum.

So that, if the proposed new building for the Patent Office received congressional sanction at once, the building would be sorely needed before its completion. A bill now before Congress provides for the erection of such a building; and, if the inventors, manufacturers and other of the numerous friends of the patent system throughout the country would follow the example of various organizations and individuals who have already acted in the matter, and make their wishes for the success of the measure known to our national legislators, there is little doubt but what the bill will become a law.

Commissioner Duell, who has been so remarkably successful in securing action by Congress looking to the relief of all other needs of the Office save this one, the urgency and importance of which thus becomes paramount, in his recent report to that body used the following language, which, in closing, I wish to quote:

"I commend to your careful consideration and heartily approve of Senate Bill No. 1,159, which provides for the construction of a 'fireproof building, for the use and accommodation of the Patent Office of the United States, including a Hall of Inventions.'"

"It is now almost universally recognized that this country owes a debt of gratitude to its inventors and progressive manufacturers. In view of the well-known fact that the inventors of the country have paid all of the expenses of carrying on the Patent Office and that this Office has covered into the Treasury over five millions of dollars in excess of all expenditures, no more fitting way of recognizing the value of the patent system to the country can be found than by using this money for the erection

of a suitable building in which the business of the Office can be conveniently and safely carried on, and at the same time giving ample space for illustrating the growth of the industrial arts by means of suitable models."

The Haskell Mud Drum.

The mud drum, shown herewith, is the invention of Mr. P. Haskell, Superintendent of Motive Power of the Chicago & West Michigan Ry. It has been in daily service almost two years on that road, giving entire satisfaction. Up to March 28, 1900, the engine had made 92,552 miles since the drum was applied in May, 1898, and the present indications are that the engine will run until the latter part of August before it is necessary to take out the flues. As shown in the illustration, it is attached to the bottom of the boiler, extending from the throat sheet to the forward course. A reinforcing sheet, shown in Figs. 2 and 3, at aa, is attached to the inside of the boiler. The mud drum is fastened to the boiler by stays, d, and is braced horizontally by the stays, c.

The openings through which the mud passes into the receptacle are about 2 in. wide, but they can be of any desired width, and Mr. Haskell believes they could be at least an inch narrower than in the design here illustrated. There is a 3 in. plug opening at the forward end into which a nozzle can be inserted, and the mud washed out through the rear opening. The mud settles into the receptacle, and in the case of engine 160 on the Chicago & West Michigan, fills it in about two weeks. One of the advantages of this receptacle is that no heat is carried to the mud except what is contained in the water; the mud is thus kept soft and can be removed in about half an hour.

Before this device was put on the engine, the flues lasted about 11 months, making about 53,000 miles. As noted, they have already run nearly twice that mileage and will last some months longer. There has been no sign of leaking due to unequal expansion or to other causes, since it was put on the en-

sidered, and the proper method of coupling to the train and making a standing test of the air brakes was described. Under running tests the Committee said:

There seems to be a great diversity of opinion relative to the value of a running test; but, as far as the Committee is concerned, it agrees that after a train has left a terminal or a point where a hose was parted, a test of the brakes should be made when leaving such points, especially when the first stop is a meeting point, or a railroad crossing. A 5-lb. reduction will indicate to the observing engineer if the train line exhaust at the brake valve is proportional to the length of train pipe, and a reduction in speed should follow if the brakes are effective. When making 5-lb. reductions for any purpose it is important that sufficient excess pressure is had to effect a prompt release of the brakes, for the slightest lowering of auxiliary reservoir pressure renders it harder to release the brakes than if a heavier reduction were made. At the same time, if sufficient excess pressure is had to cause a higher pressure in the train line than the governor or feed valve is adjusted for, and the brake valve is left in full release position too long, trouble is very liable to result by the brakes creeping on after the valve is placed in running position.

A lack of excess pressure, or a sufficient amount to effect a prompt release, after a light reduction, can be compensated for by further reducing train line, which can be done to good advantage down to equalization, with a consequent reducing of auxiliary reservoir pressure, which has to be overcome in effecting the release of brakes. Owing to greater leakage at low temperature, more trouble results by brakes creeping on from over-charging than at high temperature, and, in order to avoid the possibilities of trouble of this nature, engineers should exercise care and judgment in the operation of the brake valve. The proper length of time to leave the brake valve in full release to effect a release of all brakes and avoid overcharging, depends to such an extent on the main reservoir volume, amount of excess pressure, length of train and amount of train line reduction, that no hard and fast rule can be established. It can be said, however, that the greater the difference between main and auxiliary reservoir pressures (the latter can be determined by the train line pointer, if an over reduction has not been made) the more promptly will the brakes commence to release, and the lower the auxiliary reservoir pressure is reduced the less danger of overcharging. Engineers should study the conditions above stated and notice the air gage occasionally after the last application has been made previous to stopping, and a few seconds after release; if this is practiced it is believed the trouble from brakes failing to release and creeping on after release would be reduced to the minimum.

Detail directions were also given for making service stops and releasing in service stops to avoid the disagreeable lurch incident to a late release of the brakes. On this latter point the Committee said: "When releasing, it is good practice to always return the brake valve to running position a few seconds after release; then, if the train shows indications of running by, the brakes will respond quicker at the last application than if the brake valve were left in full release position. It might be added that there is a strong tendency to use 'just a little' of the emergency in such cases, especially if the brake valve has been left in full release a sufficient length of time to cause an overcharged train line; the passengers know the rest."

Emergency stops, the high-speed brake and handling long freight trains on level grades were but briefly discussed, as these topics were covered by reports at the last meeting.

To get information regarding the handling of long freight trains on mountain grades, the Committee made tests on a western road and the conclusions in the report were largely based on the data gathered at that time. The following are extracts from that portion of the report:

Air Supply.—The brake force being based on a predetermined auxiliary reservoir pressure, it follows that any reduction in this is accompanied with a corresponding loss in the brake efficiency. All trains tested were supplied by 9½-in. pumps and large capacity reservoirs, and the improvement in the ability to recharge and maintain pressure over the former conditions of 8-in. pumps and small main reservoirs was very noticeable. The tests demonstrated the wisdom of increasing the air supply and storage on all engines hauling long, heavy trains, particularly those operating on grades, or where the winter temperature is very low.

Driver and Tender Brakes.—The value of a good driver and tender brake in mountain, as well as in other service, is not generally appreciated. It may be here stated that the braking power of an engine weighing about 132,000 lbs. on drivers, and an empty tender weight of about 38,000 lbs. (which by no means represents the heaviest power used in mountain service) is equal to the brakes on about seven cars of 30,000 lbs. light weight, and although such driver brake may not, at its maximum efficiency and at any considerable speed, be used continuously down a long, heavy grade without excessive tire heating, it may occasionally at the most difficult parts, or at all times at lower speeds, or on levels and ascending grades.

Water Brake.—Experience in the use of the water brake has demonstrated it to be as practical on compounds as on simple engines, and the almost unlimited retarding power offered by its use should be taken advantage of. Where the driver brake piston travel is maintained reasonably short, and its continuous use on a long descending grade would cause excessive tire heating, it can be cut out on any portion of the grade and the water brake substituted. With train brakes and retainers of low efficiency, the value of the water brake as an auxiliary cannot be overestimated. We believe the best results are obtained from the use of the water brake by providing each cylinder or exhaust cavity with an independent water pipe and valve from the boiler head. This is particularly desirable on cross compounds,

Air Brake Association.

The seventh annual meeting of the Air Brake Association was opened Tuesday morning, April 3, at Jacksonville, Fla., about 100 being present. The meeting lasted three days.

In the President's address, Mr. W. F. Broadnax, of the Atlantic Coast Line, called attention to the advantages of having the car repair men under the direction of the General Air Brake Inspector. This plan has given such good results on the Atlantic Coast Line that it was suggested as a subject for consideration by the members.

The first report was "Successful Handling of Passenger and Long Freight Trains."

The Committee consisting of J. E. Goodman, Northern Pacific; J. C. McCullough, Pittsburgh, Cincinnati, Chicago & St. Louis; S. D. Hutchins, Westinghouse Air Brake Company; G. R. Parker, St. Paul & Duluth, and H. S. Belton, Chesapeake & Ohio.

The handling of passenger trains was first con-

in which the cylinders are of unequal diameter. The temperature of the main pipe, at the foot of a long grade, after the water brake has been used continuously, demonstrates the fact that the engine has been doing work, and in view of that it is apparent that the cylinders and valves require lubrication during the operation of the brake, and from the experience of some of the members of this committee, the supply of oil to the parts mentioned should be more liberal than when the engine is doing work in the ordinary manner. It is often desirable to release and cut out the driver brake and substitute the water brake when the brakes are applied without releasing the train brakes. To accomplish this there should be a release valve in the pipe between the triple valve and the brake cylinder, and in addition there should be a cut-out cock to permit of releasing the train brakes without releasing the driver brake.

Retaining Valves.—The impression prevails to a great extent that the retaining valve holds better standing than running; that the contrary is true was demonstrated by the test, and the explanation offered for this is that the resultant jar when the car is running has a tendency to seat the valve accurately, which is less likely to occur when the car is standing. The value of a good retaining valve was shown on one train tested, which was fitted with the modern retainers, the speed sheet showing a fall in speed after the release. The retaining valve on the test car being new, held about 17½ lbs., but the test showed that it is possible to increase the value beyond that amount. This was accomplished by recharging and reapplying quickly, thus closing the triple valve exhaust port before the pressure had reduced to the amount held; the pressure in the cylinder at the time of release will, of course, affect the results. Where leakage would reduce the amount ordinarily held by the retainer, the described method of increasing its value serves to render the defect less serious.

Leakage.—The opportunities for air leakage on the modern engine are numerous, in many cases main reservoir pressure is utilized for operating bellringers, sanders, blow-off cocks, ash pan slide cylinders and separate exhaust valve (compound engines), and with the latter open, when the engine is drifting, the loss of air by the piston is, as a general rule, very appreciable. Train line leakage on freight equipment is ever on guard, and in some sections of the country at low temperature the leakage past hose coupling packing rings is very serious. Old hose, with covering full of minute cracks, will, in damp weather and moderate temperature, absorb more or less moisture into the outer layer of ducking, and when subjected to extremely low temperature attain a degree of rigidity not realized except by those with experience. With the upper end of such hose improperly located so as to increase beyond standard the distance to be covered in connecting with another and with draw bars pulled out to the extreme limit, leakage is sure to occur, and, altogether it has a very detrimental effect in the operation of the brakes, especially on mountain grades. Brake cylinder leakage is, no doubt, affected by the same conditions as the hose coupling packing rings, and the loss to the efficiency of the brakes occasioned by this leakage, particularly at low temperature, can only be comprehended by those who have operated and observed the operation of the brakes on steep descending grades. At low temperature the first application of the brakes following a long interval of non-use, the effect of brake cylinder leakage on the efficiency of the brakes is made apparent by the sluggish reduction in speed, and to make the brakes more effective under such conditions better results are obtained by making the first application a heavy one. This will have a tendency to expand the leather packing, making it more pliable, and the continual applications and release, incident to mountain service, will reduce the original leakage to the amount caused by conditions other than the temperature.

Large Capacity Cars.—The large capacity cars have made their presence felt in descending as well as ascending mountain grades, but at present there is no immediate cause for anxiety, for, so long as they are air braked, leveraged properly, kept in good condition and excessively high speed guarded against, they can be safely handled. The practicability of braking these cars higher than 70 per cent. of the light weight has been established, and this, with an increasing number of air brakes, improved retainers, better general condition of brakes, the use of higher train line pressure, greater air supply and storage capacity and the possibilities offered by the water brake will render trains of such cars even safer than trains of smaller capacity cars have been in the past.

Speed.—It is usual to make rules concerning speeds permissible down steep grades; but occasionally, at least, the object sought is not attained. One reason is found in the limitation being only for the maximum speed, and in making this such that the average speed would be too low for justifiable expedition. In using air brakes to control a train down steep grades it is impossible to maintain a perfectly uniform speed; though with fair handling, the average variation should not exceed nine miles an hour, and five miles an hour is easily possible. For this reason if the speed "must not exceed," say, 15 miles an hour, and the method of handling results in an average variation of 10 miles an hour (average variations of 14.5 to 15 miles an hour have been noted in service), the average speed will be about 10 miles an hour, being probably unsatisfactory to those concerned with train service. On the other hand, if "speed must not exceed" 15 miles an hour is interpreted as requiring that the average must not exceed this, then, without considering time lost in reporting out and in, it has been demonstrated in practice that the maximum speed, the measure of safety, will reach 25 to 28 miles an hour. Finally, owing to occasionally concentrated loads and low brake efficiency, whether the latter is due to defective brakes or non-air cars, the speed limits that would ordinarily insure ample safety would here become dangerous. For these reasons the rules should comprehend both an average speed and a maximum speed; and where, for the reasons stated, a train was unusually hard to control, the rules should hold

the engineer responsible for maintaining a speed sufficiently below the limit, and enough use of the "water brake," with which all mountain engines should be provided, to insure ample safety. It should always be borne in mind that it requires far less brake retardation to keep a train from increasing in speed than is necessitated to stop it on the same grade. Hence, that the speed which may not endanger a runaway, will, at the best, require a long distance in which to stop.

Summing up the foregoing, (a) the relation between the number of good brakes and tonnage of train should be known before beginning the descent; (b) the indicated ability to control the train should be tested by the first running application; (c) this is especially important when commencing the descent of a steep grade; it should be done while the speed is low, a sufficiently strong reduction being made to insure that all brake pistons pass over the leakage grooves, and the average speed down such grades should be determined by the results of such tests; (d) the maximum and average maximum speed should be held as near the average as practicable; (e) auxiliary reservoirs should be kept as near the maximum pressure as possible, this necessitating recharging whenever the grade, curvature and main reservoir pressure offer an opportunity, or, where the previous conditions are far apart, by slowing down sufficiently; this means, as a rule, short holds, slightly heavier initial reductions, but a lighter total application between recharges than in holding longer distances, a quicker recharge and application and more uniform speed; (f) keep the driver and tender brake in good condition, use latter always and former as much as practicable, testing their condition wherever possible, after they have been used for any distance down a grade, by ascertaining the wheel tread temperature, this indicating the amount of work done. In addition, it should be borne in mind that where a stop of any considerable duration, more than about ten minutes, must be made on a grade, the air brakes should be released and hand brakes used to hold the train, the object being to guard against the train starting from the air brakes leaking off, and where the engine remains attached to the train, to have latter fully recharged when it is desired to start. When, by reason of the engine having been away from the train, the air pressure has leaked rather low, hand brakes should not be released until sufficient has been accumulated to render it safe to start, the engineer to indicate this by whistling "off brakes." Where hand brakes are released prematurely it is generally possible to hold the train with steam if it is not given a chance to start.

In the discussion Mr. T. A. Hedendahl, of the Westinghouse Air Brake Company, said that more emphasis could be laid on the use of sand; in his opinion on bad rail the sand must cover a train length of track before all danger of skidding is removed. It is well known that no amount of sand will start the wheels turning when they are once locked. He also suggested that the recoil of passenger cars just before coming to rest might be overcome if the brakes were inside-hung.

Mr. R. H. Blackall, Delaware & Hudson Company, spoke in favor of the running test of air brakes.

Mr. S. J. Kidder, Westinghouse Air Brake Company, called attention to the fact that the most important part of the report was that relating to operation on mountain grades, and this topic was then freely discussed. Mr. W. P. Huntley, Chesapeake & Ohio, said the practice on that road was to make heavy initial reductions and release and recharge as soon after an application as possible, depending on the retaining valves to maintain retardation. To get good results the piston travel must be uniform. Mr. C. P. Cass, Westinghouse Air Brake Company, spoke of the bad effects of train pipe leakage, a large portion of which is due to badly located hose; the variation of the slack in different draft gears, causing the air hose at times to become stretched and starting leaks which are not shown by the standing test. In mountain work, the auxiliary reservoir pressure should be as high as possible; then, with large main auxiliary reservoirs and large air pumps a number of quick applications and releases can be made and a fairly uniform speed maintained.

Mr. Otto Best, Nashville, Chattanooga & St. Louis, had had trouble in releasing the rear air brake on trains of 50 to 70 air-brake cars until the capacity of the main reservoir was doubled, making it 40,000 cu. in.; the pressure in this case was not increased. Hand brakes should be used merely to assist the air brakes when needed. On his road, going down steep grades the initial reduction made is 12 lbs., releasing as quickly as possible; as soon as the pressures equalize the brake valve is moved from release to the running position.

Mr. E. M. Pratt, Chicago & Northwestern, said that tests he had made indicated that an increase of main reservoir pressure only of from 25 to 30 per cent. gave practically the same release as doubling the capacity of the reservoir and leaving the pressure unchanged.

Mr. J. L. Andrews, New York, New Haven & Hartford, favored increasing both the pressure and volume of the main reservoir where long trains were to be run on steep grades. By using a double governor the higher pressure can be carried only as occasion may require. In this way he is working 50 and 60-car trains without trouble in releasing quickly; under ordinary circumstances but 80 lbs. reservoir pressure is carried, and when needed it is increased to 110 lbs. Mr. F. F. Coggin, of the Maine Central, has used the same arrangement successfully.

Other members criticising the location of air hose and angle cocks on freight cars, Mr. F. B. Farmer,

American Brake Company, said that this was largely due to the recommendation of the M. C. B. Association not being complied with. Before advocating a change of location it would be well to see if the cars that gave trouble were piped in accordance with the M. C. B. requirements. Mr. S. D. Hutchins, Westinghouse Air Brake Company, called attention to the large number of elbows used on many cars built recently. Some of these cars have from four to six elbows, and when it is considered that one elbow is equivalent to 15 ft. of pipe it is readily seen that the action of the brakes is seriously impaired.

The next report was "The Air Brake Instructor, Instruction Plant, and the Best Method of Instructing,"

the Committee consisting of I. H. Brown, Westinghouse Air Brake Company; R. H. Blackall, Delaware & Hudson Company; E. M. Pratt, Chicago & Northwestern, and John Hume, Jr., Houston & Texas Central. This report covered very fully the entire subject of air brake instruction and should be in the hands of all engaged in that work. The scope of the report is sufficiently indicated by the following headings of sub-divisions: The instructor; instruction plants and cars; best methods of instructing; instruction of officials, engineers and firemen, trainmen, machinists, car inspectors, pipe fitters; examinations; explanation of the plain triple valve, quick-action triple valve and engineer's brake valve; methods for handling passenger trains and freight trains. The following extracts are from that part of the report having to do with instruction plants and cars:

The equipment should be the same, whether a car or plant be used. There should be an air pump, pump governor, main reservoir, brake valve, and the necessary equipment for a sufficient number of cars to show the workings of the brakes on long trains. There should be at least 20 cars in number. . . . Gages should be plentifully used; also both plain and quick-action triples. Brake cylinders with stirrups for blocking up and varying the piston travel should be used. . . . It is not only necessary to have a piston travel illustration device, but at least three of them should be had, and should consist of, first, a plain triple, and the necessary equipment of a driver brake and two cylinders; second, the equipment of a tender brake; and third, a quick-action triple and equipment for a car. This will give a good understanding of the necessity of having all adjusted to equalize at 50 lbs., as well as showing that the driver brake, having two cylinders, can be adjusted to give the same power in each cylinder, and how it should be done. . . .

It was the sense of the meeting that the time was past for advocating an arbitrary excess pressure, but that this should be varied to suit the capacity of main reservoirs, the length of trains and the grades. The practice of bunching cars fitted with pipes only was wrong, and in no case should more than three of these cars be placed together. With long freight trains it was considered the best practice to stop near water stations or coal chutes and cut-off the engine, not attempting to make a stop with the train at a coal or water station. In reply to a question as to the minimum speed at which it was safe to release with long freight trains, Mr. Pratt, of the Chicago & Northwestern, said that with 60-car trains this speed was found to be 12 miles an hour under ordinary conditions, but where a portion of a long train was on either side of a summit the safe speed was still higher.

The third report was on "Lubricants for the Different Parts of the Air Brake System,"

and the Committee consisted of W. P. Huntley, Jr., Chesapeake & Ohio; F. B. Farmer, American Brake Company, and J. L. Andrews, New York, New Haven & Hartford.

In a test of six months' duration, the Committee found that the steam cylinders of 8 and 9½-in. air pumps were properly lubricated if ten drops of Galena valve oil per minute were fed through the lubricator for the first five minutes, and if for the remainder of the run one drop per minute were used. This was for pumps in good condition, and the amount of oil required would vary with the condition of the pump, the quality of the oil, the speed at which the pump is run and whether there is much exposed steam pipe. Lagging the steam pipe and the bottom of the pump governor is recommended.

Air End.—The generally commended practice for the air cylinder is valve oil. The constant increase in the number of air cars in trains, and the extra duties imposed on the pump in furnishing air for sand blower and bellringer, causing the air to obtain a higher temperature under compression than formerly, gives the necessity for employing a lubricant in the air cylinder that is capable of standing a much higher thermal test than those formerly employed. The term "valve oil" should be used advisedly; preferably an oil that does not gum up readily in the locomotive cylinders and exhaust pipes and does not form hard balls in the cylinder packing rings, will seldom give any trouble in the air cylinders. The Committee would not recommend the use of engine oil in the air cylinder, on account of the flash point being at such low temperature; its lubricating qualities would be lost on account of the heavy duty required of the pump. A steady feed of oil should be provided, and to accomplish this a good many roads have adopted an oil cup, secured to the top of the center piece of the pump, having a copper or brass pipe

running down to a swab on the piston, with the feed set so as to constantly keep a small quantity of oil on the swab. With the piston working, it will not only serve to keep the metallic packing lubricated, but the oil will be carried in thin films to the air chamber.

Brake Valve.—From different expressions received, it has been found that vaseline, Kent's Compound and mutton tallow have been used, with good results, between the rotary valve and seat; one member expressing a preference for a composition of two-thirds mutton tallow and one-third bees-wax, on account of its lasting qualities and resistance to hot air. Preferably what is needed for this is a lubricant with a good, heavy body that will not restrict the passages or ports; the consensus of opinion of the committee being that mutton tallow should be used for this purpose, also for the leather washer above the rotary valve. Piston 17 and its packing ring should be lubricated sparingly with some good oil of light body; engine oil is generally used for this purpose, about five drops being distributed evenly on the packing ring and its cylinder. The length of time between cleaning should be determined by a roundhouse test at the end of each trip, being entirely dependent on the amount of air pressure carried and whether the pump has been running hot.

Triple Valves.—In answer to queries sent out relative to the lubricants employed in triple valves, the following kinds were specified: Vaseline, Kent's Compound, valve oil, signal oil, a mixture of headlight and lard oil, 32-degrees West Virginia well oil and the ordinary car oil; one member expressing the opinion that where headlight and lard oils were used, the headlight oil would eventually evaporate; this would leave the lard oil, and acid contained therein would have a tendency to clog the piston packing ring in its groove and interfere with the proper working of the triple. The general opinion prevailing, however, is in favor of 32-degree West Virginia well oil, or car oil. Manifestly what is needed for this service is an oil with a good body, which will not gum up or clog the parts. Particular care should be taken in applying the lubricant to working parts; it should not be applied in a manner that would bring it in contact with the emergency valve seat. The expressions received tend to show that from three to ten drops of oil, properly distributed on the working parts, are generally followed in lubricating a triple. The committee would recommend the employment of about eight drops for this purpose, to be smoothed over the different surfaces with the finger; one drop to be put on the slide valve, one on the seat, three in the piston cylinder, and three around the piston packing ring.

Brake Cylinders.—The same lubricant should be employed in freight and passenger cylinders, as an item of economy as well as to get efficient service. In answer to inquiries the committee finds Kent's Compound, Paragon grease, Marvin air-brake compound and 32-degree West Virginia well oil used largely as lubricants for air-brake cylinders in different parts of the country. In order to determine their relative values, comparative tests were started with Paragon grease, Galena valve oil and summer and winter weight car oil, by one of the members of the committee. Passenger cars having 10-in. brake cylinders were used. Leathers were allowed to remain over night in the different lubricants. The cars started in service June 25, 1899. A sample of Marvin air-brake compound was received and applied to a passenger car December 22, 1899. The car had a 10-in. cylinder and the leather was treated similar to the others. The cylinders were examined February 10, 1900.

Notes on Cylinder Lubricated with Paragon Grease.—Cylinder walls in good condition, with no signs of sediment or hardness of lubricant; packing leather soft and pliable and in good condition.

Notes on Cylinder Lubricated with Galena Valve Oil.—Cylinder walls in good condition, and no signs of sediment or hardness of lubricant; packing leather soft and pliable. It was noticeable, however, that there was but a small amount of oil left.

Notes on Summer Weight Car Oil.—Leather showed signs of dryness at top. Cylinder walls were lubricated about 2 in. above center of cylinder. It appeared what had been absorbed by the packing leather was furnishing this lubrication, as the oil had settled to the bottom of the cylinder.

Notes on Winter Weight Car Oil (this was of lighter consistency than the summer weight).—Packing leather was dry at top. A light film of oil could be noted on the walls of the cylinder, but not as marked as in the preceding case; it was apparently derived from the oil absorbed by the leather, and extended below the center line of the cylinder. A small quantity of oil was found on the bottom of the cylinder.

An examination of cylinder containing the Marvin air-brake compound was also made at this time, and both cylinder and packing leather were found in good condition. This lubricant is of a soft, pliable nature, and adheres to the cylinder walls very satisfactorily.

In these tests the same amount of lubricant was used in each cylinder, viz.: 1 gill, or about $\frac{3}{4}$ ounces.

It is the opinion and belief of the committee that the method of applying the lubricant governs largely the results that will be obtained. In applying lubricant the cylinder walls should be sparingly lubricated throughout its entire length; the bearing face of leather and the narrow crevice where it joins the piston should be given as much as will adhere, and the space above the expander should be given a liberal quantity. The lubricant should be applied with the hand. Care should be taken, when applying the lubricant, to keep the leakage groove open. The packing leather should be thoroughly saturated for some time before forming on the piston. Preferably it is best to divide the time up for cleaning cylinders on passenger cars for winter and summer service, where practicable. One member of the committee has followed the plan, for the last three years, of completing the semi-annual cleanings June 1st and January 1st, the cars running in each train being cleaned as near as possible together. This insures more uniform action of each brake, and they are better able

to stand climatic conditions. It has given most excellent results.

Driver Brake Cylinders.—Valve oil, Paragon grease, Kent's Compound, 32-degrees West Virginia well oil and Marvin air-brake grease have been specified by different members as giving good results. The same lubricant used in a car cylinder should prove satisfactory in this service also. The time between cleaning and oiling is specified by different members as from six months to the time engine is returned to the shops; one member stating his engine ran 18 months between shopping, and the cylinders were cleaned and lubricated only when the engine was in shops for overhauling. The cylinders of engines referred to are located away from the heat of the firebox. The driver cylinders should run successfully from one shopping to another, if properly located away from the firebox. The committee believes that considerable saving in packing leathers will result by changing the location of cylinders subjected to firebox heat to a much cooler place. It is impossible to have a fixed rule regarding the length of time between lubrications of a "pull" brake, or where the cylinders are located close to the firebox sides subjected to heat. The reliability of the brake should be determined by the roundhouse inspector on testing the brakes at terminals. Where it is possible to convert a "pull" brake into the "push" type, much better results will follow.

Tender Brake Cylinders.—The general opinion is, the same lubricant used in car cylinder will be acceptable for this service. A tender cylinder cleaned and lubricated each time the locomotive goes through the shop for repairs should give good results.

As near as could be determined, it is believed, in lubricating cylinders, the following amount should prove sufficient and give good results: 8-in. cylinder, 3 ounces; 10-in. cylinder, $\frac{3}{4}$ ounces; 12-in. cylinder, 4 ounces; 14-in. cylinder, $\frac{1}{2}$ ounces, applied in the manner hereinbefore described. It is the belief of the committee that more successful results will be obtained in lubricating brake cylinders by employing a grease. It should be of medium weight and of an adhesive nature, to more thoroughly engage the cylinder and packing leather. It should be of such composition as not to be materially affected by change from hot to cold weather. It should act as a preservative to packing leather, and contain no ingredient liable to form gum in the cylinder.

The last report was
"How to Prevent the Ruin of Wheels from Skidding and Flattening,"

the Committee being E. G. Desoe, Boston & Albany; M. E. McKee, P. M. Kilroy, A. P. Brown and C. R. Ord. Extracts from this report are as follows:

Uniform piston travel is an important factor in preventing wheels from sliding, and the use of a good slack adjuster is recommended as a remedy. But it is suggested that while waiting for the adjuster, cars be equipped with indicators, which can be applied very cheaply. An indicator which has been in use several years, and gives good satisfaction, costing about 10 cents to make, is composed of an arm pivoted to a bracket, the bracket being fastened by screws to the bottom of the car, in line with the brake cylinder piston rod. The distance from the end of the rod to the arm will depend on our idea of how long a piston travel should be had before adjustment should be made. This arm will hang in a vertical position so long as the running travel does not exceed our limit. When it does, the arm is moved from its position, and shows train men and inspectors at a glance that the travel should be adjusted. Should slack adjusters be applied to cars equipped with indicators later on, then they would act as a check on the adjuster and show if they were doing the work expected of them.

There has been considerable said of late in regard to the best method of handling brakes on trains (principally passenger trains) to prevent wheels sliding. The principal question at variance seems to be whether stops should be made with one application, or with two or more. The committee did not think it advisable to recommend any method, but thought it best to leave the question open for discussion at the convention, and believe that all interested should express their views.

The committee first looked around to learn how wheels were generally flattened sufficient to ruin them, and, from what it was able to learn, came to the conclusion that they were either slid on sand or slid a very long distance; that is, wheels sliding, as they frequently do, a few feet at the latter end of a stop, is not the sliding which ruins them. It has been said that when a small flat spot has been made on a wheel by sliding, that every time the wheel slides afterward it will slide on the same spot, enlarging it until the wheel is ruined. From examination of wheels removed for other causes, a number of cases have come to the notice of the committee where there was a large number of flat spots about the size of a 10-cent piece, which was good evidence that when one flat spot was made, the wheel did not ever after that slide on the same spot.

It is the opinion of the committee that slid-flat spots which cause the ruin of wheels are made at one sliding, with a very few exceptions, and that the cause for such sliding is due principally to the wheels being prevented from revolving when starting, which might be due to a number of different things.

Air Brake Applied, Triple in Application Position.—Can this be prevented? The committee thinks it can. The cause is a failure to increase train line pressure above auxiliary reservoir pressure sufficient to move the triple piston to the release position, and maintaining it above or equal to it. If the triple piston packing rings are loose—that is, do not fit in the cylinder accurately—it is very likely to cause a failure of this kind. It should be understood by all having in charge the repairs of triple valves, that pistons cannot be swapped around in triples, or the rings taken out for the purpose of cleaning or renewal, and maintain a proper working triple, without the piston ring is again ground to fit in the cylinder, as it has been found necessary to do by the manufacturers of triples. Again,

with a triple in good condition, insufficient volume and pressure of main reservoir air will cause a failure of this kind. No engine running in freight service should have less than 40,000 cu. in. main reservoir capacity, and carry less than 30 lbs. excess. The committee would recommend that duplex governors be used on freight engines with the improved '92 pattern of engineer's valve, one of the governors being connected to the main reservoir pressure, and set at, say, 110 lbs., and the other connected to the port in the engineer's valve, from rotary valve to feed-valve attachment, and set at 90 lbs. This would give a pressure of only 90 lbs. for the pumps to work against when maintaining train line pressure, and when the brake is applied, the pressure in the port, from rotary valve to feed valve, will be quickly reduced through leakage in the governor attached to this port, and the pump will then be permitted to accumulate pressure until the governor attached to the main reservoir pressure stops it. This will insure a high excess pressure at a time when it is most needed.

With large capacity main reservoir and high excess pressure, a failure may occur from the handle of the engineer's valve not being left long enough in the full release position. The longer the train, the longer the pause should be made. Failure will also occur if it is left too long, charging up auxiliary reservoirs on the head cars above 70 lbs., so that when the handle is brought back into running position the train line air feeding into the other auxiliary reservoirs will cause the brake to set on the head cars lightly; and if the train has been stopped, the wheels on these cars are quite likely to slide on a bad rail when started again. Then, to prevent the brakes from being applied, the triple being in application position, when they should be released: First—Triple piston rings should have a good ground fit. Second—Large capacity main reservoir should be used on engines handling long trains, and high excess pressure carried. Third—Engineers should be instructed as to the time necessary to permit the handle to remain in full release position.

With some makes of quick-action triples in use, it may not be possible to cause train line pressure to be greater than auxiliary reservoir pressure, on account of train line exhaust port to atmosphere remaining open after an application. Careful inspection and care about making repairs should prevent trouble from this source.

Air Brake Applied in Release Position.—There are several things which might occur to cause the air brake to be applied—that is, the brake held on by air in the cylinder, with triple in release position. First, and probably the most common, is the pressure retaining valve being cut in.

In the discussion Mr. G. Fredericks, Philadelphia, Wilmington & Baltimore, stated that in using inside-hung brakes on passenger cars it had been necessary to reduce the braking pressure from 90 to 80 per cent. of the light weight on account of the large number of slid wheels. Mr. T. W. Dow, Fitchburgh, said that the flange brake shoe having a face wider than the tread of the wheel was conducive to skidding. This is remedied by making the face of the shoe about $\frac{1}{8}$ -in. narrower than at present. Mr. E. M. Pratt doubted the conclusion of the Committee that serious flat spots were mostly made by one sliding and thought that the greatest damage was done through successive sliding on the same spot; it was also difficult in such cases to find who was responsible. Mr. Kidder stated that when plain shoes are replaced by flanged shoes of the Ross-Mehan type there is a tendency to slip the wheels, and where this is done the braking pressure should be reduced by 15 or 20 per cent. Mr. Otto Best, Nashville, Chattanooga & St. Louis, said much of the trouble was due to improper maintenance of the brakes and the failure to use slack adjusters. In answer to a question, Mr. C. D. Hutchins said that in releasing, the brake valve should be kept at release from 5 to 15 seconds for trains of from 5 to 50 cars. A number of members favored two applications of the brakes instead of one in service stops, but it was held to be bad practice to make more than two applications.

The Secretary reported a total membership of 558, of which 99 were new members joining since the last meeting.

The subjects for reports and the Committees for the next meeting are as follows:

1. The pressure retaining valve; its value, present general condition, and how it may best be improved and maintained.—Committee, J. H. Stricklyan, D. M. & M.; J. Casey, M. St. P. & S. S. M.; E. Kronberg, N. P. Ry.; G. P. Parker, St. P. & D., and W. L. Clendenen, C. M. Ry.
2. Terminal test plants; why and when needed, methods of installation and operation.—Committee, S. D. Hutchins, W. A. B. Co.; W. T. Hamer, S. Ry., and Otto Best, N. C. & St. L.
3. Data concerning air brake methods in different sections of the country.—C. B. Conger, Locomotive Engineering.
4. The angle cock; M. C. B. location and degree of conformity with those recommendations. How the cock should stand, i. e., pointed upward or toward the center of track, average condition, etc.—Committee, R. C. Augur, New York Air Brake Co.; P. Stack, U. P. Ry.; E. L. Bouchard, C. R. of G., and W. White, M. C. Ry.
5. Past, present and future relation of the work required of the air brake and its ability to perform it.—Committee, J. E. Goodman, N. P. Ry., and L. M. Carlton, C. & N. W.
6. Air pump exhaust for passenger train heating.—Committee, F. F. Coggin, M. C. R.R.; E. G. Desoe, B. & A., and C. S. Hall, B. & M.

Mr. C. B. Conger was also appointed to collect data regarding air brake practice in the country. This paper

will include the length and rate of grades exceeding one per cent.; grades requiring the use of all retaining valves; percentage of weight braked on passenger and freight cars, tenders, and on the drivers and trucks of locomotives, and the main reservoir capacity now used on passenger and freight engines.

The election of officers for the ensuing year resulted as follows:

President, R. H. Blackall, Delaware & Hudson Co.; First Vice-President, Otto Best, Nashville, Chattanooga & St. Louis; Second Vice-President, J. E. Goodman, Northern Pacific; Third Vice-President, W. P. Huntley, Chesapeake & Ohio; Treasurer, E. G. Desoe, Boston & Albany. Members of Executive Committee: F. C. Cross, Plant System; F. F. Coggin, Maine Central, and G. R. Parker, St. Paul & Duluth. F. M. Nellis was re-elected Secretary.

It was decided to hold the next annual meeting at Chicago on April 30, 1901.

The Westinghouse-Parsons Steam Turbine.

In 1896 the Westinghouse Machine Company acquired the patent rights in the United States and Canada for the Parsons steam turbine. Work has

Some General Details.

The speed of the turbines and generators is 3,600 r. p. m., and each set weighs, complete, 25,000 lbs. The turbines are designed for condensing the exhaust, which is done by means of a combination of a pair of jet condensers and compound air pumps, in which the air and water are handled in separate cylinders. The pumps for these cylinders are operated by a 50-h.-p. belted Westinghouse type "C" motor, taking current direct from the bus bars. The vacuum in the turbines is often as high as 28 in., the average barometric reading being 29.25 in Pittsburg. The water is delivered to the boiler at nearly the same temperature as that of the steam in the condenser. The construction of the turbine is such that the steam expands in stages, and the temperature consequently falls gradually and continuously from the admission to the condenser. The turbine may have a little advantage in efficiency over the reciprocating steam engine in that the exhaust pressure is from 1 to 1½ lbs., while in the reciprocating engine it is considerably more than this.

Fig. 2 shows the external appearance of one of the turbines at Wilmerding. A cast-iron base supports a cylinder having three different diameters from the inlet to exhaust. Many parallel rows of guide blades, about 3 in. in height, are fastened in

cessively that number of times for giving motion to the shaft.

In the absence of a detail drawing, we will describe as well as possible the flow of steam from admission to exhaust: It first enters parallel to the shaft into the small end of the cylinder and expands through the first set of guide vanes; and it then impinges against the next set of vanes (which are on the smallest drum of the shaft) and it gives up nearly all its velocity. In expanding through the moving blades, the steam again attains velocity and bounds back, striking the stationary vanes of the next ring and rushes again successively to rows of movable blades and fixed vanes. In each of the three steps of the cylinders are several grades of expansion, obtained by increasing the spaces between the rows of blades. This action is repeated until the steam reaches the exhaust chamber. The turbine is thus a multi-expansion engine with as many expansions as there are rows of blades. The ratio of expansion between inlet and exhaust is 96 to 1.

The Bearings.

The high speed has called for a special design of bearings in order to eliminate all vibration and permit the shaft to revolve about its true center of gravity instead of the geometrical axle of revolution. The bearings are made of several concentric sleeves of brass around the journal, and fit each other loosely, allowing annular spaces for oil between them. This forms a self-centering cushion, which permits the shaft to center itself when running. The sleeves show no signs of wear, because of the films of oil between them. The shaft has a little play, thus allowing some motion, which is an important element in the easy running of the machine. The bearings made in this way are automatically lubricated by an oil pump mounted on the sleeve coupling between the turbine and generator, which pumps the oil into a tank, from which it circulates,

under pressure into all the bearings. From the bearings it is piped down into a cooling well. There is no internal lubrication. This greatly facilitates the working of the surface condensers, as the condensed water can be pumped back to the boiler free of oil.

The End Thrust of the Shaft.

To counteract the end thrust on the shaft due to the axial impact of the steam on the moving blades, the shaft is held in equilibrium by means of three balancing discs in the turbine casing. The discs

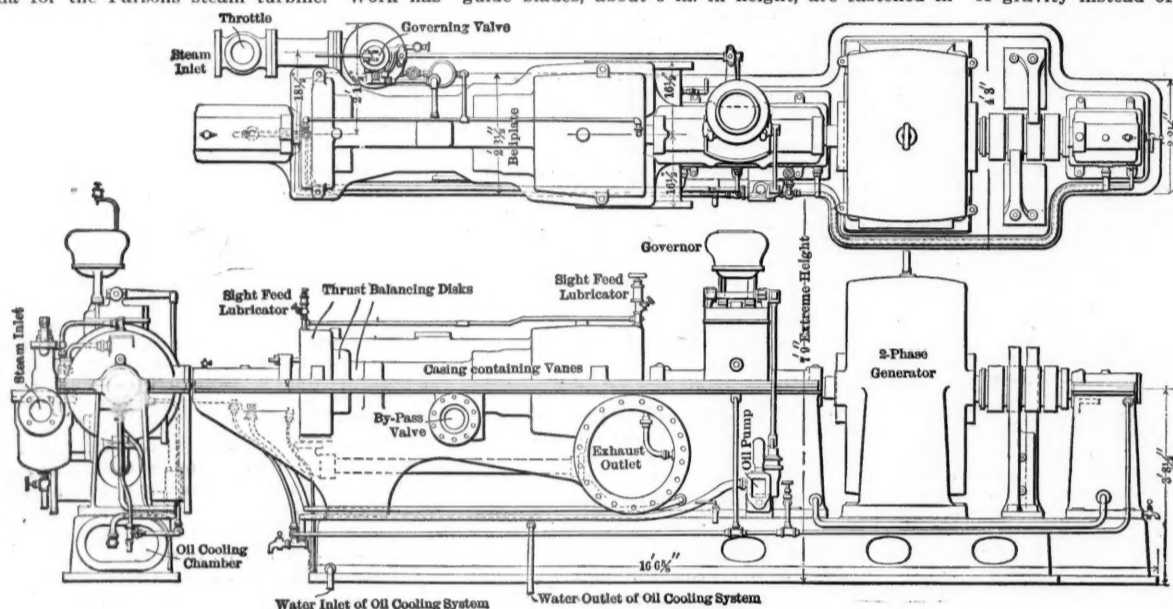


Fig. 1.—General Plan and Elevation of a 500-H. P. Westinghouse-Parsons Steam Turbine.

been steadily progressing since then, an engineer for years identified with the Parsons turbine in England having devoted his time to its development in this country. In order to test the machines thoroughly by operation in their own works, the first large installation of steam turbines in this country has been made in the power plant of the Westinghouse Air Brake Company, at Wilmerding, Pa., where they have been running for several months, driving electric generators. These extensive works now rely entirely on the turbines for motive power. The power house containing these machines has eight water-tube boilers, 350 h. p. each, working at a pressure of 125 lbs., and equipped with Roney stokers. The steam engines formerly used have been taken out from the adjoining engine room and the space is partly occupied by three Westinghouse-Parsons steam turbines direct connected to 300-kw. two-phase alternating-current generators, the three sets of machinery being run in parallel to furnish current for the entire works.

A plan and elevation of one of the 500-h.-p. turbines is illustrated in Fig. 1, and an engraving from a photograph is shown in Fig. 2. Although these machines aggregate 1,500 h. p., yet, standing side by side, the space occupied is only 25 ft. x 20 ft. The bed plate of each machine measures 16 ft. 7 in. x 4 ft. 3 in. The whole plant, including two 10-h.-p. reciprocating steam engines, which drive small dynamos, two pairs of condensers and air pumps, and the switchboard, occupies a space of only 29 x 36 ft. The foundations consist of ordinary brick piers, without any foundation bolts, these being unnecessary, as there are no heavy reciprocating parts.

the interior of each. A shaft carries three drums having the same diameters as the three sizes of the cylinders. Upon these drums are mounted parallel rows of guide blades, which are curved vanes about 3 in. in length, secured radially, and spaced to fit between the rows of guides fastened to the inside of the cylinders. The determination of the theoretically correct design of the blades is by no means a simple problem. Those who have had experience in the design of water turbines know that a rigid mathematical analysis is required in order to deter-

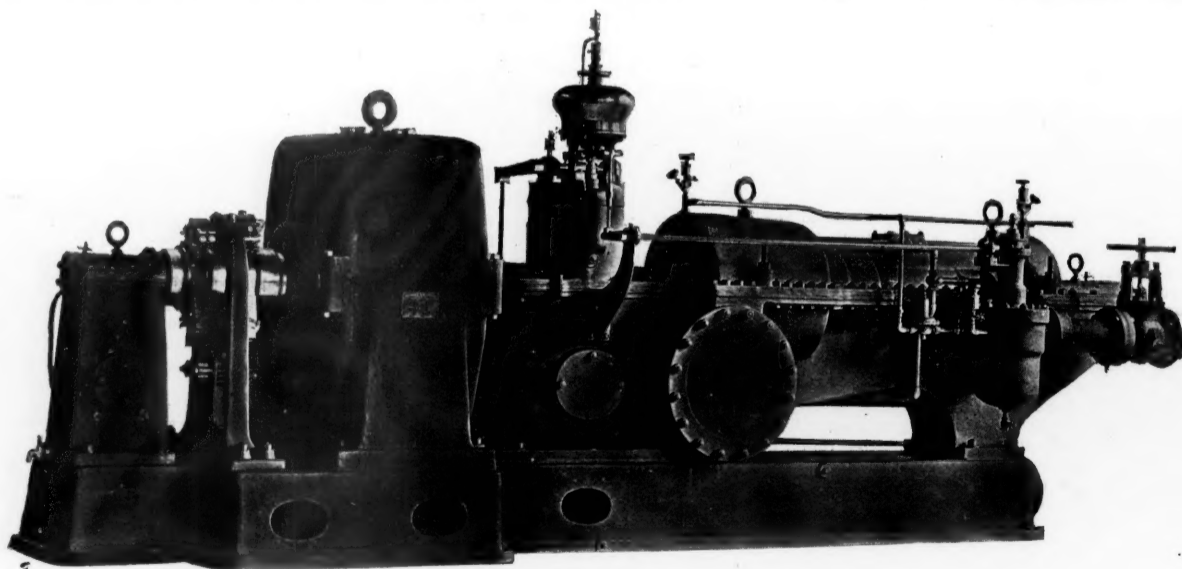


Fig. 2.—A 500-H. P. Westinghouse-Parsons Steam Turbine, Direct-Connected to Generator.

mine the shape of vane that will give the highest possible efficiency, and the same is true of the steam turbine.

Flow of the Steam.

The rows of stationary vanes are inclined just enough to guide the steam so that it will strike the movable vanes, and a rotating movement is thus given to the shaft. As there are 58 rows of blades on the drums, the steam in expanding is used suc-

are in fact pistons rotating in cylinders, with the steam pressure on one side. They are made steam tight with the cylinder, and the diameter of each is equal to the diameter of the corresponding drum upon the shaft driving the moving blades. These disc chambers are connected by core passages through the cylinder casing, with the spaces occupied by the corresponding drums, so that the thrust can be accurately balanced under all variations of load. By this construction the shaft has a very

slight end thrust, which is taken up with an ordinary thrust bearing. The steam cylinder just referred to has a by-pass valve, which, when open, admits live steam direct to the second or intermediate section of the cylinder. This may be used to increase the capacity of the machine when running under a heavy overload, or it may be used to develop full power in case the condenser is not being used; but this increase of power is obtained at the expense of efficiency.

The Regulation of Speed.

The plant at Wilmerding is, so far as we know, the first instance of direct-connected generators being driven by steam turbines, the speed of steam turbines having heretofore been reduced by gearing or by flexible shafts. The speed is governed so there is no undue stress or any jerk on the machinery. The governor of the turbine is a very interesting feature. It is of the fly-ball type, and intermittently cuts off the steam supply entirely for a longer or shorter period, according to the load. Lever and shaft connections from an eccentric, driven by a worm on the main shaft, work a small piston valve, which controls the larger main admission valves, also of the piston type. The small piston valve operates the large piston valve in the main steam supply end of the turbine. At full load, the valve is open nearly all of the time, but at very light loads it remains closed most of the time. At intermediate loads it is intermittently opened and closed, corresponding with the oscillations of the small piston valve. For turbines of 500 h. p. there are 150 oscillations a minute. The governors are extremely sensitive, and may be adjusted to run within a small fraction of one per cent., variation between no load and full load; but as these generators have to run in multiple, it was desirable to have a considerably greater variation, that each generator might carry its share of the load. The speed of the turbines and the inertia of the rotating part are so great, while the friction is so small, that the turbine will continue running for 20 minutes after steam is shut off. By an adjustment on the governor the

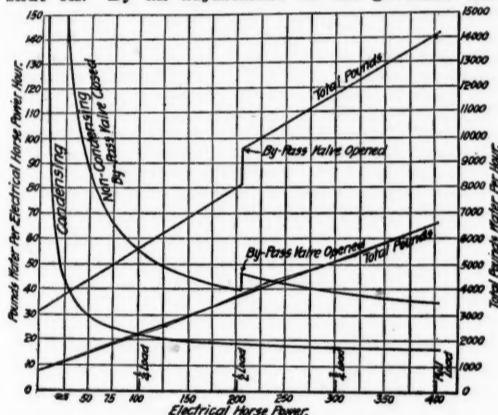


Fig. 3.—Water Consumption of a 500-H. P. Westinghouse-Parsons Steam Turbine.

speed within wide limits can be varied as desired while the turbines are running, in order to bring the dynamos into synchronism, and the loads thus proportioned as may be required.

The Generators and Motors.

The generators are bi-polar, working at 3,600 r. p. m., giving a two-phase alternating current of 440 volts at 7,200 alternations per minute, each having a capacity of 300 k. w. The switchboard of nine panels follows the usual Westinghouse practice, having one panel for the exciters, three for the generators, a load panel, one feeder panel for light, and three feeder panels for power. On the back of the board are two sets of bus-bars, providing for throwing the power circuits on one set, and the light circuits on the other set separately, or the two together. Several Westinghouse type "C" induction motors varying from five to 100 h. p. have been installed in the various departments of the works, the majority of them being fastened overhead on the pillars of the buildings, where they occupy no valuable space, the power being applied through lines of shafting to which the motors are connected by pulleys. These motors have been substituted for steam engines which formerly supplied power, as the entire machinery in the works is now electrically driven.

Tests for Economy.

The turbines have been subjected to extensive tests, from which the remarkable efficiency curves shown by the diagram, Fig. 3, have been plotted.

From the diagram it will be noted that running at one-quarter load, 22 lbs. of steam were consumed per electrical horse-power hour; at one-half load, 18.9 lbs.; at three-quarters load, 17 lbs., and at full load, 16.4 lbs. When running light, 750 lbs. steam per hour are consumed. It should be noted that the figures of efficiency given in the diagram are based on the electrical horse-power hour. It is estimated that the turbines are at full load working on 13.2 lbs. of steam per indicated horse power per hour.

These turbines were designed for giving their best

results when running condensing, thus accounting for the comparatively poor results, as shown in the economy curves, when running non-condensing. Turbines of the same type can, however, be designed for working non-condensing, which would give good results. The effect of opening the by-pass valve is also shown on the curve diagram.

A 2,500-h. p. Turbine.

A larger turbine than those described in this article is now approaching completion at the works of the Westinghouse Machine Company. It will be installed in New York as an addition to the plant of the United Electric Light & Power Company, which recently consolidated with the Edison Company and others, under the control of the Consolidated Gas Company. This will be the largest turbine driven generating set ever built, being rated at 2,500 h. p., with a possible capacity of 3,000 h. p. It will run at 1,200 r. p. m., with a steam pressure of 150 lbs., and will deliver 60-cycle current from a 6-pole generator rated at 1,500 k. w. The shaft of this machine, complete with its spider and guide blades, weighs 28,000 lbs.

Greater progress in building turbines has hitherto been made in Europe than in this country. Two of 1,400 h. p. capacity each have been built for an electrical plant in Germany, these being the largest yet attempted by the English makers. Steam turbines of smaller size are in use in several central stations and traction plants in England. It may not be out of place to remind the reader that the "Viper" of the British navy, a torpedo boat destroyer run by the Parsons steam turbines, has attained a speed upward of 40 miles an hour, which is the highest recorded speed yet reached.

The Ajax Plastic Bronze for Bearing Metals.

As known to every student of bearing metals, the progress in the art of making a good and durable bearing has resulted largely from the addition of lead to a compound of copper and tin, in proportions which cannot, however, be considered as definitely fixed. The bearings more commonly used have approximately 80 parts of copper, 10 of tin and 10 of lead. The radical change in the theory of the composition of bearings came from many important tests made by the Pennsylvania Railroad some years ago, from which it was found that the copper-tin alloy of seven to one, as then in common use, was inferior to the copper-tin-lead composition, which was first combined with phosphorus, but the percentage of this element has been gradually reduced.

The recognized importance of these tests and the far-reaching conclusions drawn therefrom, make it desirable by way of introduction to the subject of this article, to refer briefly to them. The following is from one of the many Pennsylvania Railroad tests:

Metal tested.	Composition.			Phosphorus.	Arsenic.	Relative wear.
	Copper.	Tin.	Lead.			
Phosphor bronze, standard.	79.70	10	9.60	.80	...	1.00
Ordinary bronze.	87.50	12.50	...	...	...	1.49
Arsenic bronze, "A"	89.20	10	...	.80	...	1.42
" " "C"	82.20	10	7.00	.80	...	1.15
" " "E"	79.70	10	9.50	.80	...	1.01
Bronze, "K"	77.00	10.50	12.50	...	...	.92
	77.00	8.00	15.00	...	...	.86

The most important conclusion from this series of tests was that in general the greater the percentage of lead used the less was the wear of the bearing. It was also found that the wear diminishes with the lower proportions of tin. The conclusion was drawn, moreover, that metals containing over 15 per cent. of lead or less than eight per cent. of tin could not be successfully used because of segregation; but with a decrease of tin and an increase of lead a better metal would result, providing the composition could be made homogeneous. These general conclusions have been confirmed by more recent experiments. The conclusions reached that there is an almost constant relation between wear and the proportion of lead used, and that the bearing with as large a percentage as possible of this element there is relatively less friction, has recently led the Ajax Metal Co. to introduce lead in larger proportions than heretofore attempted. Those who have followed the articles on the Microstructure of Bearing Metals in the 1898 volume of the Railroad Gazette* know of some of the difficulties encountered in making a homogeneous metal that will be free from crystallization and other objectionable features in a good bearing. The value of lead as an element in the composition, and the use of phosphorus as a deoxidizing agent, were carefully considered.

All this leads up to a discussion of the results obtained by the patented process of making bearing metals which contain a relatively large percentage of lead. The process covers broadly the method of preventing segregation, the evils of which are only too well known. The new metals have been given the name of Ajax Plastic Bronze. The results of the comparative tests with Ajax bearings and with phosphorus-bronze bearings, as re-

*See Railroad Gazette for 1898: Feb. 25, page 133; March 4, page 157; March 25, page 212; April 8, page 249; May 13, page 336.

cently made on an Olsen friction machine, are reported as follows:

	Friction (in lbs.)	Temperature (above temp. room)	Actual wear (in grains) 1,000,000 revolution.	Compression at 2 1/2 fold (lbs. per sq. in.)
Phosphor bronze.....	16 1/2	50	10.5	31,700
Ajax standard engine bearing	18 1/2	32 1/2	7.2	19,550
" 31% lead	18	44	6.7	19,100
" 30% "	16	40	3.00	17,210
" 47% "	13 1/2	34	1.65	8,690

The above is the strongest argument we have seen for the introduction of a large percentage of lead, but engineers generally will be interested in following this subject still farther when more tests shall have been made.

Much might be said on the question of the segregation of the metals. Suffice it to say that we are assured that the introduction of lead by this process makes a homogeneous mixture entirely free from crystallization. Where there is segregation, parts of the metal may be relatively very hard and others soft, and this difference, of course, results in too much friction at some places. One of the greatest aids to determine the composition of metals, and one which has had a wide influence in the development of the art during the last few years, is the scientific use of the microscope to determine the physical condition of the bearing, and one may form a pretty good notion of the value of some investigations which have been made, by reading the articles referred to which we printed in 1898.

Grade Crossings in Washington.

Three bills have been introduced in Congress this session having for their object the elimination of grade crossings in the city of Washington.

The first of these provides that the Baltimore & Ohio may change its tracks on certain streets, may build a viaduct on which to bring its trains into the city above grade, and may establish a new freight yard and terminals. The object of the changes proposed in this bill are to move the passenger station from C St. and Jersey Ave. to the square bounded by C St., North Capitol St. and Delaware Ave., to move the junction of the main line and the Metropolitan Branch from E St. to a point beyond the city boundary, to establish freight yards north of Eckington, and to run all trains into the city along Delaware Ave. The bill originally provided that the cost of changing the grades should be borne equally by the company and the District Government, and the bill is now being considered by a sub-committee of the Senate District Committee with a view to establishing the items of cost which shall be divided between the District and the company. The District Committee has ordered a favorable report.

The second bill provides that the Baltimore & Potomac (Pennsylvania) may change the grades of its tracks within the District, depressing them or building viaducts as necessity may require. The bill also provides for the reconstruction of the bridge across the Potomac River and for minor changes in the tracks. The clause of the bill relating to the bridge over the Potomac is still unsettled, and has been referred to a commission, consisting of the Engineer Commissioner of the District, Colonel Allen, in charge of the reclamation of the Potomac Flats, and Chief Engineer Brown of the Pennsylvania Railroad, which is charged with determining the kind of a bridge to be built and its height above high tide. The District Committee of the Senate has ordered a favorable report when these points have been cleared up by the sub-committee.

The third bill provides for the acquisition of the valley of Rock Creek by the District of Columbia, the building of a sewer to accommodate the waters of the stream, and the construction above it of railroad tracks, to be owned by the District, and over which the trains of all railroads entering the city from the north or the east are to run. Roads from the south or the west are to be brought in over a bridge across the Potomac to a point which will connect them with the Rock Creek tracks. The scheme contemplates building a union depot, bridging the Potomac into Virginia, the establishment of a common freight station, and the abandonment by compulsion of all other entrances to the District by steam railroads.

Foreign Railroad Notes.

The increase in the number of express trains in Prussia, largely provided with what we would call drawing-room cars, in which a seat for a day's journey is secured for 48 cents, has had as a result a notable increase in first-class travel, though these cars afford seats for second-class passengers also.

The increase in the wages and salaries of the Prussian State Railroad employes has been such that the force employed in 1900 will receive \$17,000,000 more than if the wages of 1890 were paid. But the rise in wages has been general in other occupations as well.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.

The Status of the Steam Motor Car.

The steam motor cars built for trial within the last few years by several roads, for one reason and another have not fulfilled expectations, and oftener than otherwise they have been failures. In general, it is safe to say that so far the only important result of the trials is to show some of the difficulties in the way of building and operating these cars. All this is to be regretted as tending to discourage further effort.

The best results seem to have been obtained with the car built for the New England Railroad (New York, New Haven & Hartford), which is still in service and now is used for a short run on the New York, New Haven & Hartford, near Dedham, Mass. This car, so far as the mechanical features are concerned, is said to be fairly satisfactory, and we are informed that the only parts of the construction subject to criticism are the longitudinal timbers which are light for the suspended load, at the center, of 600 gallons of water. This, of course, is a thing easily corrected in a new car.

While one man can easily do all the work of the head end, nevertheless for what we may call strategic reasons, two men have been used on this New England car, and this has made the cost of operation about the same as for a small locomotive. Under such conditions the locomotive, having a larger boiler, can do more work in an emergency and is preferable.

In other cases, failures to realize anticipated savings have been due rather to mechanical imperfections. The tubes of the vertical boilers have given trouble through overheating and the magazine feature of the boilers has not been satisfactory, requiring much attention from the engineman to keep up the fires. Also, the heavy condensers placed in the roof cause the cars to sway. In one case where the engines of a car proved entirely too small for the work, the failure was probably due to the car being planned and built without consulting the mechanical department of the road. On another road after many efforts had been made to overcome the defects of the boiler the car was finally taken out of service. In another case a motor car was run for some time over a branch railroad, making 75 to 80 miles a day. Various defects developed. The boiler did not have enough steam capacity and the engine rode very hard. More heating surface in the boiler was obtained by putting in more flues and the cylinders were bushed down $1\frac{1}{2}$ in., and the spring rigging of the engine end of the car was changed. Still this motor car did not give good service. It lost time for want of steam capacity and was still objectionable to the men on the engine end on account of hard riding. An ordinary train had frequently to be put on because of failures of the motor car. As a result of careful study of the cost of operation for three months, it was

discovered that it was actually greater with the motor car than with a regular train.

We think it is true that the summing up of the whole experiment now is that the only car of this class now running is the one on the New York, New Haven & Hartford, and that even this is only partially satisfactory.

It is quite evident that the steam motor car, although highly desirable, has made little progress, is still an experiment, and its future is uncertain. While a good many have worked on the problem no really profitable results have been obtained. It has been suggested that where it is intended to have but one man in charge of the boiler and engines, oil fuel could best be used and that the usual baggage space could better be utilized for oil tanks and to give space for a horizontal boiler.

Two Recent Rate Decisions.

The decision of the Interstate Commerce Commission, refusing to order the restoration of low commutation rates between Washington and Baltimore, which had been withdrawn by both of the roads running between those cities, was reported in the Railroad Gazette of March 9, page 158. The full report, which has since been issued, contains a discussion of more than ordinary interest. The dissenting opinion of Commissioner Clements well sets forth the argument for the complainants, emphasizing the permanent character of low season-ticket rates and the consequent injustice of a sudden advance in such rates; and the fact that such rates between large cities and their suburbs have been justified by the courts, not merely as excusable exceptions to the ordinary rule of equity, but as in accord with true public policy.

The majority report discussed the bearing of the anti-trust law on a case of this kind, and the conclusion reached affords a luminous commentary on the curious relation of that statute to transportation rates, and the interstate commerce law. It will be remembered that for 14 years or more, season-ticket passengers had been carried between the cities named for \$34.75 a quarter, equal to less than half a cent a mile; and that all at once, on short notice, or no notice, both roads withdrew these tickets, leaving the lowest existing rate \$46.35 a quarter. The collateral questions and minor considerations are too numerous to summarize, and we call attention to the report merely to inform the reader of its character, so that he can get a copy if he wants one.

Commissioner Clements sustains his argument by strong doses of "Dutch justice," citing decisions of the Supreme Court; while Chairman Knapp, writing the opinion of the majority, concludes that the clause in the Interstate Commerce Law which says that that statute "shall not prevent the issuance" of commutation tickets practically makes it unlawful for the Commission to declare that a commutation rate which is much lower than the single-ticket rate is unreasonably high.

Another Commission decision which makes interesting reading is that on the complaint of the city of Danville, which was written by Mr. Prouty, and was reported in the Railroad Gazette of March 23.

Danville is 66 miles south of Lynchburg, Va., on the Southern Railway, and this road brings freight to Danville and to Lynchburg from Louisville, Cincinnati and Chicago (by a roundabout route through North Carolina) as well as from New Orleans; and also to Danville from the north. Lynchburg enjoys active competition, the Norfolk & Western and the Chesapeake & Ohio both running through the city. The rates from Louisville, etc., over the Southern to Danville are much higher than to Lynchburg, and the same complaint is made concerning shipments from New Orleans directly over the Southern, and also by way of Louisville over the other two roads; and also on shipments from New York by water to Norfolk, whence the distance to Lynchburg and to Danville is about the same, but by different roads. The rates from the West to Lynchburg are very low, not only because of the natural competition of the rival roads, but also because of the severe competition to all the Atlantic seaboard ports. Baltimore has a rate from the West which is a certain amount below that to New York; Norfolk has the Baltimore rate, and Lynchburg was granted the Norfolk rate.

When the Interstate Commerce Law went into effect, in 1887, the Chesapeake & Ohio decided to conform to the spirit of the fourth section, and changed its tariffs so that interior points, like Lynchburg, should not be charged rates higher than those to the seaboard terminals. The other roads followed the C. & O., of course. Lynchburg is about on the dividing line between northern territory and south-

ern territory; and in the latter this conformity to the long and short haul law does not so generally prevail; in fact it is said that conformity is the exception; through rates on the Southern Railway and on other lines in that territory are made to compete with ocean rates, and are often lower than the rates to intermediate points.

We cannot take the space to recount all the features of this case, but we mention the decision for the purpose of noting the chief reasons why the Commission decides that Danville, not a competitive point, must be placed more nearly on an equality with Lynchburg, a point enjoying strong competition. They are (1) Danville's importance as a commercial center, and (2) its nearness to Lynchburg. Before the Southern Railway bought the Virginia Midland and the Atlantic & Danville, Danville enjoyed competition from the north and east; and while the enterprise of the Southern Railway, in consolidating numerous independent railroads and thus benefiting the community, is commendable, the interests of the people must not be ruthlessly brushed aside. The competition which the citizens of Danville had secured helped them to build up business, and their work must not be brought to naught. The existing differences in freight tariffs are found to be very large, and they are ordered reduced to very moderate percentages. The report recognizes the serious consequences to the Southern Railway of any reduction in rates to Danville, but, on the other hand, it is believed that reductions will build up the city and thus be to the advantage of the road. In its defense the Southern insisted that if it should withdraw from Richmond, Lynchburg and Norfolk business, Danville would still receive no benefit, but Mr. Prouty takes leave to doubt this conclusion, and says:

"The desire to transact business at the more distant point is a continual inducement to the Southern road to obtain an equitable adjustment of rates between the intermediate and the more distant point. If the Southern can only do business at Lynchburg by procuring a just relation of rates between Lynchburg and Danville, it becomes for the interest of the Southern road to secure that adjustment of rates, and it will use all its enormous power to that end. To-day the Southern Railway constructs its Danville tariffs with reference to its own interest alone. An order requiring a proper relation of rates between Danville and Lynchburg as the condition of transacting business at Lynchburg compels that company to consider the interest of Danville as well as its own."

Liquid Air Again.

About a year ago we took occasion to prick Mr. Tripler's liquid air bubble, which then seemed to be misleading some people. As our readers know, another bubble, much larger and more dangerous, has lately been floated, and while no straight thinking man will be misled, the matter should not pass entirely unnoticed. The Tripler Liquid Air Co. has issued a prospectus (which we believe is usually accompanied by a blank for subscriptions to the stock of the company) containing an array of statements which shows pretty well how easily the imaginative mind of a pseudo-scientist works when the object is to obscure the normal vision of the investor. It is to be hoped that Mr. Tripler had nothing to do with the making of the pamphlet, for it is not creditable to a man who has rendered some really valuable services to science. From among the many extraordinary assertions made in this remarkable pamphlet we quote the following in reference to the use of liquid air for locomotives:

"By the utilization of the great preponderance of oxygen contained in liquid air, thereby guaranteeing far higher degree of combustion in coal than is now attained by the most advanced methods, the increase from the present power secured of about 10 per cent. is derived to such an extent that the saving in the cost of fuel will be fully 50 per cent., say nothing of the enormous saving in dead weight."

"When one stops to consider the hundreds of thousands of locomotives now in use over the entire world, he cannot fail to be amazed by the marvellous possibilities in this single branch of utilization of liquid air."

The phrase "hundreds of thousands of locomotives" is an important and instructive example of the loose and exaggerated statements of this prospectus. Probably all the locomotives in use in the world number little more than one hundred thousand. We shall not stop to look up the figures; the estimate is close enough for our present purpose.

The fallacy of the first of the paragraphs quoted is shown by a simple calculation. A gallon of liquid air weighs about 9.3 lbs., 23 per cent. of which is oxygen, making the oxygen in one gallon equal to 2.1 lbs. If the liquid air could be produced, as claimed, for two cents a gallon, the oxygen would cost 0.95 cent a pound, or \$19 a ton. It takes about $2\frac{1}{2}$ lbs. of oxygen to burn one pound of carbon (Bloxham on Metals, p. 3), making a cost of $19 \times 2\frac{1}{2}$ = \$50.66 to burn \$3 worth of coal, if we take that as the price per ton. We are left to assume that "the enormous saving in dead weight"

will more than compensate for this. But a generous interpretation of the meaning of the first paragraph quoted might lead one to think it was proposed simply to add enough oxygen (say 27 per cent.) to the air to give better combustion and yet not enough to add largely to the expense. It has been claimed, and we understand by no less authority than Prof. Pictet, that in firing a steam boiler by assisting the combustion of the coal with 50 per cent. oxygen, a quantity of fuel can be saved equivalent to the amount usually lost in heating the nitrogen of the air. The oxygen, we are told, is to be generated by an essentially new method. We have made a calculation, based on the assumption that the oxygen is produced by liquid air in a Tripler apparatus at two cents a gallon (which can probably not be realized for some time to come); but our results do not make it evident that we can hope to gain enough to pay for the cost of the oxygen. If Pictet can prove his assertion, we have before us the possibility of developing a commercial industry, the importance of which will be at once recognized.

As bearing on the general subject of the use of liquid air for driving a reciprocating engine, the reader may recall the results of some researches by Dr. Henry Morton (see Railroad Gazette, May 5, 1899), in which he found that by Tripler's method of producing liquid air, and at a cost of 20 cents a gallon, the fuel expense to run an engine directly by liquid air would be 26 2/3 cents as against three or four cents per horse-power-hour for a steam engine. In consideration of the many ridiculous claims by advocates of the new power, we venture to suggest that the second paragraph in the quotation from this interesting pamphlet be made to read: "When one stops to consider the hundreds of thousands of imaginative ways in which liquid air can be used over the entire world, he cannot fail to be amazed by the marvelous possibilities of the human mind when unrestrained by the elementary principles of science."

Railroad Earnings and Security Values.

Railroad earnings have continued to increase all this year at a rate hardly looked for a few months ago. The reports of nearly all the large companies have now been published for February, showing remarkable gains in gross and net revenues. One month's results are of little consequence as showing the trend of receipts, but the publication of the February statements makes the record complete for three-quarters of the fiscal years of many companies, and the showing of gains exceeds the best reports made for the period in any previous year. The amount of the increases would be striking at any time, but their significance now is that they follow heavy increases for three successive years, during which the gains have been growing larger and larger. A few examples will suffice.

The Atchison in its last fiscal year increased its gross revenues by \$1,300,000 and its net by \$2,200,000, but in the eight months of the present year its gross income has been further expanded by \$3,500,000 and its net by \$3,975,000. The Chicago, Milwaukee & St. Paul gained \$4,121,000 in gross in the 12 months to June 30, while in the eight succeeding months it gained \$2,810,000. The Northern Pacific's enhancement of \$2,369,000 in gross and of \$1,115,000 in net in the 1899 fiscal year has been nearly equalled so far in the new fiscal year, with gains of \$2,154,000 and \$994,000 respectively. Altogether the record of gains by the companies which have so far submitted their February reports makes an extraordinary showing. Several have added over \$3,000,000 to their totals of gross in the eight months since June 30, which is the close of the fiscal years of most of the lines; over half a dozen others have gained approximately \$2,000,000 and over, and none fails to show a substantial increase. How impressive the exhibit is will be seen by the following figures, which give the increases in gross and net earnings of the more important companies reporting for the eight months to Feb. 28:

	Inc. gross earn.	Inc. net earn.
Atchison, Topeka & Santa Fe....	\$3,449,159	\$3,974,404
Baltimore & Ohio.....	3,558,400	3,626,576
Chesapeake & Ohio.....	899,231	248,378
Chicago, Burlington & Quincy...	2,876,364	1,023,462
Clev., Cin., C. & St. L.....	1,399,565	698,640
Denver & Rio Grande.....	674,679	88,048
Erie.....	3,854,536	1,083,600
Louisville & Nashville.....	3,237,876	1,263,847
Norfolk & Western.....	1,522,122	1,063,614
Northern Pacific.....	2,496,549	1,207,704
Philadelphia & Reading.....	2,490,727	268,674
Southern Pacific.....	6,086,039	2,609,272
Southern Railway.....	2,517,463	826,384
St. Louis & S. F.....	590,276	344,983
Union Pacific.....	1,810,194	733,921
Wabash.....	1,623,726	1,031,074
Hocking Valley.....	961,362	567,887
Chicago, M. & St. P.....	2,810,378	D. 365,593
Illinois Central.....	2,951,831	1,474,62

The actual gains are not only large, but the ratio of improvement is in most cases surprisingly good. Increases of gross and net equal to 10 per cent. are quite general; a considerable number do better than this, as the Baltimore & Ohio, the Union Pacific, the Southern, etc., while some of the companies, like the Louisville & Nashville and the Norfolk & Western, gained 20 per cent. and over.

The exhibits of the companies are anything but

uniform in the relation of net gains to gross. Some companies report a small and even a merely nominal change in net returns, with heavy enhancement in net. The Reading, the Lehigh Valley, the Southern and the Union Pacific, with the Pennsylvania, until the last month or so, may be singled out as companies falling under this head. The Chicago, Milwaukee & St. Paul has gone a step beyond these companies, and despite its great expansion in gross revenue, reports less net revenue so far in the present fiscal year than in the corresponding period in 1899. We have official statements to explain this result in its case, the policy of the company being to carry out extensive improvements to the property out of gross earnings. Practically every company named in the table above is setting aside liberal sums out of current revenues for betterment work of different descriptions, but none has carried this policy to the extent which has been done on the St. Paul. As contrasted with the exhibit made by the latter in its net revenue, the returns of the Atchison and the Baltimore & Ohio, which report gains in net revenue considerably in excess of those in gross, may be mentioned. Yet each of these companies is carrying out comprehensive improvement work at the cost of current income.

The increased cost of working, through the advance in the cost of supplies, in wages, etc., should seemingly have told heavily in the period covered by these reports. We have, indeed, the testimony of the managers of many companies, as well as other evidence, that this has worked to reduce the net returns.

The growth of revenue indicated above has, of course, increased the balances available for dividends. Some of the exhibits in this regard are striking. Thus, the Atchison, in the eight months, has more than earned its proportionate charges and over 5 per cent. on its \$114,000,000 of preferred stock. The Baltimore & Ohio is earning at the rate of 10 per cent. on its common shares of \$45,000,000 after allowing for the preferred dividend charges; the Union Pacific shows 7 per cent. on its common shares, the Northern Pacific is doing about as well, and similar statements might be made for all the companies whose figures have been given.

The prosperity of the railroads has been reflected in stock market values during the year. The low prices for the shares of most of the railroads this year were early in January, and their present prices are the highest of the year, and in most cases, particularly in the so-called medium priced stocks, this week's prices are much above the best quotations recorded, even in the "wild" speculative markets of 1899. The "industrials," however, are under an eclipse.

Annual Reports.

Chicago & Alton.—The annual report of the Chicago & Alton, for the year ending Dec. 31 last, shows the first material improvement in traffic and revenues since the recovery in 1895 from the depression of the previous year. The loss in revenue had become so serious that in 1897 the dividends on the two classes of stock were reduced to seven per cent. a year, after being maintained at eight per cent. for over ten years. The income account for 1899 shows that the seven per cent. dividends were earned with a balance over of \$287,455, against \$99,385 in 1898 and \$40,851 in 1897. The gross earnings from operation were \$7,155,961 in 1899, against \$6,693,295 in 1898. Exact comparisons are not possible, because the company has now adopted the Interstate Commerce Commission's classification, and the revisions of the income account are carried back only to the 1898 figures. On this basis the increase in the gross earnings is \$462,666, or 6.9 per cent. The increase in operating expenses was \$186,939, and in net receipts \$268,167, being over 11 per cent.

The number of tons carried increased 3,251,600, or 14.6 per cent., and the ton-mileage 61 1/4 millions, or 12.3 per cent. The passengers were 258,000, or 13 per cent. above the 1898 figures. The 1898 freight movement was less than in any year before 1893, back as far as 1882. Even the gains shown in 1899 were exceeded in several years in the eighties.

The stationary freight movement, with the consequent decline in earnings, because of the falling rates, offered the opportunity, carried out in the past year, to change the control of the stock. This was sold to a syndicate of Eastern bankers who expect to secure their profit through the refunding of the debt, and by the better position they expect to secure for the property by arranging new Western connections, beyond the Missouri River. In connection with the development of the traffic of the company, the plans of the new owners provide for extensive reconstruction work, and these have already been undertaken. President Felton says that contracts for betterments already let include important new bridge work and 62,000 tons of rails, besides extensive grade reductions. The new equipment ordered, part of which had been delivered in 1899, includes 1,800 thirty-ton cars, 800 fifty-ton coal cars, and 77 heavy freight, passenger and switching engines.

NEW PUBLICATIONS.

The State Highways of Massachusetts.—Seventh Annual Report of the Massachusetts Highway Commission. January, 1900. Boston: A. B. Fletcher, Secretary.

In 1892 an Act was passed to establish a highway commission in Massachusetts, and in 1893 an additional Act put the matter in a working form. In 1894 still another Act was passed further amending the law. Under these Acts the Commission has built in the aggregate 250 miles of State highway and petitions have been received for many miles more. The total of the petitions covers about 1,300 miles of road, and these come from 273 towns and 24 cities. The Commission asks for an appropriation for the year 1900 of \$500,000 to carry on the work. It also expresses the opinion that two of the commissioners should devote their entire time to this work, receiving a salary of \$5,000 a year each, while the third commissioner (at \$1,000 and traveling expenses) should act as Chairman of the Commission and give to the work such time as is necessary for general supervision.

The general theory on which this work was begun in Massachusetts is to build detached pieces of good road in different parts of the State, these being intended to serve as object lessons for the various communities. The aim is to lay out roads of actual utility, but the fundamental notion is to teach the people the value of good roads, the possibility of having them, and the methods of building and maintaining them. When a town or county petitions the Commission for a road and the petition is approved, the Commission makes an estimate for building that road. The towns or cities then have the privilege of taking the contract to build the road at an agreed price. If the towns do not take the contract it is let at public auction. In any case, however, the county grades the road and builds culverts and bridges. One-quarter of the money spent by the State is to be repaid by the counties within six years. The Commission may contract with the city or town, or with private parties, for keeping these roads in repair, and it may plant suitable shade trees and provide watering troughs. As we have said, the miles built now aggregate something over 250.

The seventh annual report of the Highway Commission, dated Jan. 3, 1900, is just issued, and may be had from the Secretary of the Commission. It contains a good deal of information of interest to engineers and indeed to all citizens. The most important part of the report is found in an appendix, being the annual report of the geologist, Mr. L. W. Page.

Mr. Page has served as geologist to the Commission ever since its formation, and has done much valuable work for it in the laboratory at the Lawrence Scientific School, Harvard University, and made careful studies of road methods abroad. In the year just ended the work in the laboratory has gone on as in previous years, many specimens of road metal having been received and submitted to abrasion tests and cementation tests, besides which a method has been established for determining the power of absorption of rock, and all of the important samples received at the laboratory recently have been tested for absorption. In this report the geologist discusses at considerable length the physical properties of road materials and the causes of their deterioration. He treats of the wear directly from traffic, of chemical decomposition, and of the action of frost and wind and rain. He then describes the desirable properties of road material, as hardness, toughness and binding power, and describes various methods of making laboratory tests. These cover methods used abroad, as observed in his recent visit to Europe. Various machines are described, with illustrations, and especially the apparatus devised by Mr. Page himself and used successfully in the laboratory of the Commission, and now installed in several engineering schools. This apparatus includes an abrasion machine, an impact testing machine, and methods of investigating binding power and absorption.

The tables appended to the report give the properties of a great number of samples that have been tested. Other tables show contract prices for work done, and the cost per standard mile of road. Two hundred and twenty miles of macadam have cost \$9,931 a mile. This average, however, does not mean much, but the particulars of this road are given in detail. Another table gives particulars of the cost of repairs and maintenance. This naturally varies so much that an average would be worthless.

The Theory and Practice of Surveying. By J. B. Johnson, C. E., Dean of the College of Mechanics and Engineering of the University of Wisconsin, etc., etc. Fifteenth edition, revised and enlarged. New York: John Wiley & Sons, 1900. Price \$4.

When a book has entered its fifteenth edition, has been in the hands of appreciative readers for more than 13 years and has become a standard text book in numerous technical schools, it hardly seems necessary to review it. Prof. Johnson, in his preface, tells us that the principal changes in this edition are:

A new field method of determining the refraction correction to apply to the declination setting in solar

azimuth work, devised by G. C. Comstock, Professor of Astronomy in the University of Wisconsin.

A description of the slide-rule, with illustrative examples of its use.

Various improvements in the field methods of surveying with the transit and stadia, prepared by L. S. Smith, Assistant Professor of Topographical and Geodetic Engineering in the University of Wisconsin.

The chapter on Mining Surveying has been entirely rewritten by Prof. Robert S. Stockton, E. M., of the Colorado State School of Mines, Golden, Colo., and by Mr. Edward P. Arthur, Jr., E. M., U. S. Deputy Mineral Surveyor, Cripple Creek, Colo.

A new Appendix B, being the latest Manual of Instructions for the Survey of Mineral Lands, brought up to 1899.

A new Appendix I, a reprint of the latest Rules for Restoring Lost Corners as issued by the General Land Office at Washington.

We need add nothing to this statement other than to say that the new articles on the stadia cover the use of an interval factor, a simple way to determine the wire interval of a transit, and the prevention of systematic errors. The purpose of the interval factor is to make it practicable to read one and the same rod with telescopes having different wire intervals. Having a rod graduated to the standard units the reading taken from it is multiplied by a factor peculiar to the telescope used. This method has not been adopted because of the extra computation, but by the use of a reduction table the labor is made very small. It is found that with a little practice and the help of a reduction table the field notes of an entire day may be reduced in 15 minutes or less.

The Consolidated Iron & Steel Companies.—The American Iron & Steel Association has compiled a list of the consolidations of iron and steel companies which have taken place in the United States since Jan. 1, 1898. The list is issued as a supplement to the Directory published annually by the Association and is corrected to February, 1900. It is an octavo volume of 56 pages and is to be obtained from Mr. James M. Swank, General Manager of the American Iron & Steel Association, at No. 261 South 4th St., Philadelphia, Pa. The price of the supplement is \$2. The last addition to the Directory of Iron and Steel Works appeared in 1898, and this supplement brings matters up to date. It contains an authorized description of the organization of each of the consolidations mentioned, giving capitalizations, officers and character of plant. Mines, coke ovens, railroads and ships owned by the consolidated companies are also given.

TRADE CATALOGUES.

Car Couplers, Buffers, Vestibules, etc.—The Gould Coupler Co., 25 West 33d St., New York City, with offices in Chicago & St. Louis, and works at Depew, N. Y., issues its catalogue for 1900. This contains good illustrations, with descriptions, of the various devices made by the Gould Company, and these are so well known that we do not need to enumerate them. It may be well to remind the reader, however, that besides couplers, buffers and vestibules the company makes steel platforms and draft rigging, malleable iron draft beams, steel axles, brake-slack adjusters and special malleable castings. The steam forge which was burned in 1895 was rebuilt with improved facilities and the company is prepared to furnish forgings in considerable variety. It is also prepared at its various works to supply malleable and steel castings. A novelty which we discover in this catalogue is an improved attachment to the lock of the freight coupler, designed to quicken the action of the lock and to prevent "any possibility of its being displaced by shocks." With this attachment the lock, it is said, cannot vibrate out of place. This consists of an eye bolt connection to the back of the lock which has a spring, abutting against a lug in the shank of the coupler. The action of this spring is forward and downward and the spring is long and works under limited compression. If it should break, the lock is still operative. An excellent feature of the catalogue is that the drawings are given with such clearness and completeness that one can get considerable satisfaction in studying the details.

Inspection Cars.—The Light Inspection Car Co., formerly the Railway Cycle Mfg. Co., of Hagerstown, Ind., issues a small pamphlet showing various designs of inspection cars of the Hartley & Teeter patents. These cars are essentially of bicycle construction; that is, with tube frames, bicycle saddles, pedals and handle bars, wire suspended wheels and ball bearings. They are provided also with rubber tires and an efficient brake. One can imagine that great speed can be made with these cars and that one can get over the track with them with the minimum of effort. These cars are made to carry one or two persons.

The Link-Belt Machinery Co., Chicago, has issued a 6 x 9 in. pamphlet illustrating different kinds of elevators and conveyors for handling general merchandise. These include inclined carriers for han-

dling freight from floor to floor in the same building, horizontal endless carriers and various styles of continuous freight elevators for small packages and barrels; somewhat similar elevators are used for handling ashes in power stations. Much of this apparatus is especially adapted for use in large freight houses and at docks.

The Boston Belting Co., Boston, Mass., has issued a little 16-page pamphlet entitled "Do You Know?" and in answer to the question the company explains it was established in 1828; that it makes all kinds of mechanical rubber goods, including belting, diaphragms, gaskets, hose, mats, matting, packings and numerous other articles; and that it makes these articles in many different forms.

Ventilating Fans.—The American Blower Co., of Detroit, Mich., sends catalogue No. 111, showing and describing a variety of disk ventilating fans. Vertical and horizontal fans are shown, to be run by steam and by electricity, either belted or direct-connected. Prices, dimensions, weights and capacity are also given.

Signaling as it is and As it Might Be.

AN IDEAL ORGANIZATION.

BY A. H. RUDD.

(Continued from page 197.)

The writer is perfectly aware that his ideas may by some be deemed extravagant from a financial standpoint, but are they not on the lines of true economy?

Although gross earnings are now largely increased, rates have not advanced and supplies have. High prices affect employees as well, and in order to enable them to live as comfortably as heretofore, their wages must be adjusted to this rise; otherwise they become discontented and seek other fields of labor where they can get more. How, then, can economy be effected? In manufacturing it is accomplished by labor-saving machines. In railroading it can be done—to mention one way—by increasing the capacity of present main lines, through shortening the intervals between trains. In large yards, the number of switchmen may be reduced by concentrating the control of switches under one or two men. A good many dollars are paid each day for foot races back and forth. Proper signaling will accomplish this end, though it is difficult to demonstrate in cold figures what this saving would be.

Block signaling is a species of insurance, and the only true way to estimate its value is to summarize the accidents occurring for a number of years, note carefully the cost of those which proper signals surely would or possibly might have prevented, and, then consider how many installations might have been paid for by the sums lost. Consider the cost of delays involved. Also the cost of detentions, which, even without accidents, might have been avoided in the ordinary course of traffic through more rapid handling of trains. Then remember that "an ounce of prevention is worth a pound of cure," multiply the amount of wreck damages by sixteen, and contemplate the result!

The following organization is suggested for a large road. For smaller roads some of the assistants may be dispensed with. It will be noticed that the Lehigh Valley organization has been quite closely followed, that being one which measures up to the requirements, better than most, and which with slight modifications will give the best results.

ORGANIZATION.

The Signal Engineer will report to, and receive his instructions from, the head of the engineering [or transportation] department, and will have charge of the installation and maintenance of all mechanical, automatic, electric and interlocking signals.

He will prepare plans, specifications and estimates for all new plants, and superintend their erection and installation.

He will prepare plans and instructions relative to the proper mechanical construction, manipulation and maintenance of all classes of signals, which, after approval by his superior, shall become standard. (Instructions regarding manipulation must also be approved by the General Superintendent, if the Signal Engineer reports to the Chief Engineer.) It shall be his duty to enforce adherence to such standards and instructions.

He will superintend the maintenance and any alterations of existing plants and fixtures.

He will make frequent inspections of all signaling plants and apparatus, and see that they are properly operated, and maintained in a satisfactory condition.

He will make periodical reports relative to the operation of the signaling systems under his charge.

He will investigate all reports of detentions to trains caused by failures of signals, and of damage done to signal plants or apparatus, reporting his findings and recommendations in the matter to his chief, to the Division Superintendent, and to any other official who should take cognizance of same.

He will prepare statements showing the cost of maintenance or installation of the various plants or branches of the service.

Division Superintendents will furnish the Signal Engineer any information and assistance he may require to enable him to discharge all the duties assigned to him.

All employees must obey the instructions of the Signal

Engineer in all matters relating to the proper construction, maintenance, and mechanical manipulation of the signal plants or fixtures in their charge.

The Signal Engineer will advise the division operators as to the disposition to be made of all messages relating to signal interruptions.

No removals or alterations, other than routine repairs incidental to the proper maintenance of signals, will be undertaken without orders from the Signal Engineer; excepting in emergency cases, in which event the Signal Engineer shall be notified as soon thereafter as possible, and satisfactory reasons given.

All requisitions for signal supplies will be prepared by the Signal Engineer, so as to insure perfect uniformity and accuracy of definitions.

The Signal Engineer will give special attention to training the various repairmen, to secure a reduction of expenses and higher efficiency of the force, by combining the work connected with the various classes of signals, as far as feasible.

The Signal Engineer will be assisted by an Electrician, a Supervisor of Interlocking, a Foreman of Signal Construction and a clerk (and draughtsman, if necessary). These will report to the Signal Engineer and be assigned their respective duties by him.

The Signal Engineer will report on a special payroll, to his superior, the time of all his men engaged on work on the different divisions, such time to be charged to these various divisions and the bills forwarded to the respective Division Superintendents.

For the head of such an organization a man should be chosen who can be implicitly trusted. He must be skilled in mechanical work, so that in designing standards, he may embody the best known practice, or improve upon it. He must be able to work out his own locking sheets, and make plans so perfect in detail that the Foreman of Construction will not have to spend half his time overcoming unexpected obstacles, which make the original plans impracticable, and the balance of it figuring out how the work is intended to be installed. He must understand all the problems to be solved, and be an electrician of ability, with thorough knowledge of the principles and methods of working the different systems, so that in designing his circuits no chances may be left for the display of clear signals erroneously. He must have knowledge of all the economic features of the profession, and possess a large share of executive ability.

Such men are to be found to-day, and are only waiting for the opportunity to demonstrate their ability when their handicap is removed. They should be given the opportunity to prove their competence, and when they have done it, be paid salaries commensurate with their positions and with those of other officials with like responsibilities.

They should have sufficient office help to enable them to get about and see what other signalmen are doing, and be allowed the necessary money for this purpose, that they may continually broaden and keep out of a rut. Then the Signal Engineer should be given, not absolute freedom from restraint by any means, but sufficient help, at large enough wages, to ensure the best results, and authority much beyond that with which any such officer is at this time entrusted.

Each autumn Division Superintendents should render reports of the points they deem it necessary to have signaled the ensuing year, the General Manager selecting from them the work most desired. Detailed plans and estimates on a liberal scale should then be prepared by the Signal Department after consultation with the engineering force as to possible track changes to simplify the signaling. A decision should then be reached as to the funds available for the purpose, and the points to be protected finally chosen. A secondary list could be made, of less important places to be attended to, if saving enough is effected over the estimates of the first list to allow it without exceeding the appropriation. In this matter of plans absolute authority should be given the Signal Engineer.

A little signaling, like a little knowledge, is a dangerous thing. If the work is worth doing at all it is worth doing well.

An installation should be complete throughout. All possible routes should be signaled and separate levers provided for at least the high speed route signals and preferably for all. All switch and lock levers should be underloaded rather than overloaded. Two or three light levers can be handled more quickly than one heavy one, and the maintenance cost is decreased 40 or 50 per cent. by such arrangement. It also lessens in great degree one of the danger points in mechanical interlocking; that of the switch remaining in one position with its lever in the other, through a broken connection, thus releasing the locking for a wrong route.

Careful inspection has sometimes prevented such trouble, but the possibility of it, though remote, exists. An additional and perfect preventive is the installation of circuit breakers in connection with and operated by the facing-point switch itself in each high-speed route and placed in circuit with electric locks on the levers of signals governing over the same. Electric locks should also be provided in all cases where detector bars will not absolutely protect, and especially to hold routes after distant signals have been cleared. These points, often neg-

lected, provide loopholes in the system and an axiom of signaling science is that "if there is a possible chance for any mistake, it will certainly be accepted sooner or later."

Expenditures on these lines will not be as impressive to the traveling public as fine stations and grounds, beautiful flower beds and other ornamentation and luxurious cars, but the lack of them will more forcibly impress this same public when avoidable accidents occur through their omission.

In the automatic block signal field, trolley and other foreign currents frequently pass over the rails, and knowledge of means to counteract them is often essential to prevent the most serious results.

Materials and workmanship in installation should be of the best. The almost universal employment of wood for foundations necessitates expensive renewals on an average every five or six years. During renewals switches and other functions must often be disconnected and worked by hand. The use of concrete or cement piers obviates this necessity, and the additional first cost is more than saved in a short time.

The Signal Engineer, who understands these matters, should have final decision as to plans, materials and methods of construction.

[TO BE CONTINUED.]

Present Status of "Light Railroads" in England.

What are the best means of encouraging the building of light railroads? constitutes Subject 38 for discussion at the International Railway Congress, to be held next September; and reports on the subject have been made by Mr. Joseph Tatlow, Manager of the Midland Great Western Railway of Ireland, and by Mr. W. M. Acworth. Mr. Tatlow reports for Great Britain and Ireland; and the report, with appendix, fills over 80 pages of the Bulletin for January. Mr. Tatlow discusses the law in detail, gives a history of State-aided railroads built in Ireland since 1839 and then goes on to tell what has been done under the Light Railway law of 1896. Only one railroad has been finished and put in operation under this law, but the applications which have been made and the action of the Board of Trade and the Light Railway Commissioners on these are reported at great length. Inquiries were made of 44 railroad managers in England and replies are given showing their views on the subject of building inexpensive railroads to accommodate rural districts. Mr. Tatlow refrains from stating his conclusions as to the probable benefits of the Light Railway act, as it will be necessary to wait for further experience before it will be possible to form an opinion. The Act appears thus far to have worked with smoothness and efficiency.

Mr. Acworth was asked to treat the subject with reference to countries other than England, but he says that he has no special knowledge which would enable him to do this successfully, and he makes a short report criticising the working of the English Act. He has no great hopes of beneficial results from this law, for the reason that the relaxation of the restrictions which are imposed by the Government on the construction of standard railroads has not been carried far enough. The standard of construction and of safety is still too high. Many of the companies already started are likely to find it impossible to earn a profit on their capital. The Government grants not more than 20 per cent. of the capital necessary, even in poor districts, while railroads already running in Ireland have been built at the sole expense of the Government. State aid is difficult to manage at best, as it will be impossible to adjust the rival claims of old unsubsidized railroads and new State-aided lines.

TECHNICAL.

Manufacturing and Business.

George A. Barden, formerly Superintendent of the works of the Standard Pneumatic Tool Co., Chicago, has been appointed Eastern Agent of the same company, with headquarters at 619 Washington Life Building, 141 Broadway, New York.

McCord & Co., Chicago, makers of railroad supplies, have moved their Chicago offices to Suite 1475, Old Colony Bldg.

The American Locomotive Sander Co., of Philadelphia, informs us that on the first of the month it had on its books orders for 901 track sanders for future delivery. This indicates a rapid growth in the application of sanders to locomotives.

F. M. Pease, of Chicago, has bought all the narrow-gauge rolling stock of the Baltimore & Lehigh RR., which road is now being made standard gauge. Mr. Pease has also delivered 50 box cars to Swift & Co. and 100 cars of the same type to the Pittsburgh, Shawmut & Northern RR.

The Illinois Central is building a second Jordan earth and ballast spreader. The Grand Trunk has bought from H. H. McDuffy, sole agent, 521 Monadnock Block, Chicago, a license to build two of these machines for use in the grade reduction and double track work to be done this season on the Chicago & Grand Trunk division.

The New York offices of the Chicago Pneumatic Tool Co. have been moved from 122 to 95 Liberty St.

Iron and Steel.

Jones & Laughlins, Ltd., operating the American Iron & Steel Works at Pittsburgh, Pa., and Laughlin & Co., owning and operating the Eliza furnaces in the same city, which are practically the same interest but which have been operated separately, have been merged into one company hereafter to be known as the Jones & Laughlins, Ltd., capitalized at \$20,000,000. The officers of the new company are: B. F. Jones, President; C. M. Laughlin, Vice-President; Willis L. King, Secretary, and B. F. Jones, Jr., Treasurer. The holdings of Laughlin & Co. in the Lake Angelina Iron Co., the Monongahela Connecting R.R. and in ore, coal and coke properties have also been acquired.

Bids will be wanted about May 1 by James H. Purdy, Thornton, N. M., President of the Cochiti & Northwestern Ry. Co., on 52-lb. rails.

Horace Crosby, Second Vice-President of the National Tube Co., died of pneumonia at his home in Allegheny, Pa., April 5. He was born in Belfast, Me., December, 1847.

The Detroit Bridge & Iron Works has a contract with the Grand Trunk Ry. for bridges requiring 4,000 tons of material, and also a contract for 2,000 tons of bridge steel for the Missouri Pacific.

Owen Sound, Ont., offers subsidies, etc., for an iron and steel plant to cost \$600,000. A company is being organized with a capital of a million dollars.

The Blue Bell Iron & Steel Co. of Philadelphia, Pa., has been incorporated in Delaware, with a capital of \$300,000, by Herman Becker, Edwin A. Yarnell and Joseph W. Thompson, all of Philadelphia.

The Risdon Iron & Locomotive Works, San Francisco, Cal., are reported to have secured control of the Pacific Rolling Mill of that city. It is stated that the Risdon Co. will spend about \$3,000,000 for a ship-building plant and a large dry dock.

The Pittsburgh Steel Construction Co. has been organized by Geo. M. Bole, John L. Mullen and others, and headquarters have been opened in the Westinghouse Bldg., Pittsburgh. The company proposes to build steel bridges, buildings, etc.

Col. David Campbell, Superintendent of the Empire Iron & Steel Company's furnaces at Philadelphia, Pa., died in that city April 3. He was born in Middletown, Pa., Dec. 30, 1832.

Andrew D. Cramp, at one time Superintendent of the Cramp ship yards at Philadelphia, died in Boston, Mass., March 29, at the age of 43. He was a son of William H. Cramp and was born at Philadelphia.

Three bills before the Ontario Legislature authorize municipalities to grant bonuses to companies establishing iron and steel works. One bill is to enable the city of Collingwood, Ont., to pay \$115,000 to the company which proposes to establish a steel plant at that place. Another is to enable the town of Fort William to grant \$50,000 to the Mattawin Iron Co. which will build an iron furnace in that town. The third is for a \$25,000 grant for a copper smelter in the same town.

The Lukens Iron & Steel Co. is having a universal plate mill built at Coatesville, Pa., to roll plates from 9 in. up to 48 in. wide and 100 ft. long.

The Maryland Steel Company, Sparrow's Point, Md., has an order for 1,510 tons of rails for the Metropolitan Railway of London, England.

The Nashua (N. H.) Iron & Steel Co. has been sold to the Eastern Forge Co. of Boston, Mass. E. F. Chandler, the present manager, will continue to act as agent.

The Gillette-Herzog Mfg. Co. of Minneapolis, Minn., has the contract to rebuild the Convention Hall at Kansas City, Mo., which was destroyed by fire last week. The Carnegie Co. will supply the greater part of the material.

New York State Canals.

The bill appropriating \$200,000 for surveys of the canals of the State of New York was unexpectedly passed last week at Albany.

The Nicaragua Canal.

So far as we can now judge the Nicaragua Canal bill will not be passed at this session, although of course we cannot be certain until Congress has adjourned. No doubt its passage this session would be premature and unfortunate, considering the very important report that the Commission is certain to make within the next 10 months.

Steel Underframe Cars.

The Pressed Steel Car Company has taken an order from the Philadelphia & Reading Railroad for 540 box cars with steel underframes. These cars are of 50,000 lbs. capacity. The company has also an order for 1,000 gondola cars with steel underframes from the same road. The company will add somewhat to its new establishment at McKees Rocks for the purpose of building cars of this type.

Cost of Treating Ties at Edgemont.

In describing the tie treating plant of the Burlington & Missouri River RR. in our last issue, page 213, it was said that the cost of treating by the chloride of zinc or "Burnett" process (which is used at Edgemont, S. D.) is from 12 to 15 cents for each

tie. We learn from the Chief Engineer of the road that these figures are a little too high, the cost being from nine to ten cents, and never exceeds the latter figure.

Grand Trunk Railway Bridges.

In the annual report of the Grand Trunk the Chief Engineer says the replacement of the old bridges, which are too light for the present loads and rolling stock, by others sufficiently strong to meet all probable future requirements, has been carried on more slowly than was expected by reason of the impossibility of obtaining the necessary steel for superstructure. All the bridges between Montreal and Island Pond, a distance of 147.83 miles, have been finished, and trains of maximum weight are now running over them. Between Island Pond and Portland, 149.42 miles, the renewal of the bridges is being pushed forward as rapidly as the short supply of material will permit. The Victoria Jubilee bridge has been finished, including roadways, footpaths and approaches, and was opened to the public Dec. 1 last.

Carnegie Pattern Shop Burned.

The pattern shop of the Carnegie Steel Co. at Homestead, Pa., was burned during the night of April 7. Numerous patterns and armor-plate drawings that were to be submitted to the Navy Department were destroyed. The loss was \$75,000.

Chicago Drainage Canal.

Water was turned into the Van Buren St. by-pass, Chicago, on the morning of April 6. Its completion is the last important work remaining on the drainage canal, and the filling of the tunnel will diminish the velocity of the current in the Chicago River. The by-pass at Adams St. was opened Nov. 2 and noted in our issue of Nov. 19, 1899. The combined length of the two by-passes from Adams to Van Buren Sts. is about 1,150 ft. They are crescent-shaped tunnels under the west bank of the South Branch of the Chicago River, and were made necessary by the narrowness of the river and its inability to carry the required amount of water. They will carry 100,000 cu. ft. of water a minute at their fullest capacity. The tunnels run under three buildings, three railroad tracks and the teaming yards of the Fort Wayne railroad and the work has been done without causing any interruption to traffic. They are 50 ft. wide and 16 ft. deep, with concrete walls on both sides, on which rest steel girders weighing 15 tons each, placed 10 ft. apart. Between the walls concrete arches 4 ft. thick at the girders and 15 in. thick at the crown are built to add to the strength of the surface. Lydon & Drews had the contract for the substructure, in which 2,500,000 ft. of timber (board measure) and 76,000 lineal ft. of piles, and 8,000 cu. yds. of concrete for the walls was used. The superstructure was built by Griffith & McDermott, and 4,000 cu. yds. of concrete and 1,500 tons of steel have been used by them. The work has been carried on day and night and Sundays under the direction of Mr. G. M. Wisner, who has been the engineer in charge, and it has cost about \$550,000.

Subway to East Boston.

The Boston Transit Commission has asked for sealed bids for building Section A of the East Boston tunnel in Maverick Sq. and Lewis St. The section consists of about 139 ft. of open incline, and 680 ft. of two-track subway. Bids will be received at the office of the Commission, 20 Beacon St., Boston, Mass., until 12 o'clock noon, Friday, April 20. A bond to the amount of 20 per cent. of the contract will be required. H. A. Carson is Chief Engineer.

Block Signals Needed in France.

The Minister of Public Works in France has designated the following lines which it is declared should be equipped with the block system as soon as practicable. He specifies the portions which should be first equipped as follows, Table No. 1 giving the most important, and Table No. 2 those next to be looked after:

TABLE NO. 1.

Line.	Km.
State Railroad, Chartres to Bordeaux (sections not yet equipped).....	434
Paris to Royan.....	47
Total	481
Eastern	6
Southern	206
Orleans, main lines 302 km., branch lines 237 km.....	539
Western, main lines 127 km., branch lines 170 km.....	297
Total	1,628

TABLE NO. 2.

Line.	Km.
State lines, Nantes to Bordeaux.....	373
Paris-Lyons Mediterranean, main lines and branches	895
Orleans, Brive to Montauban.....	163
Western, main lines and branches.....	174
Total	1,605
Aggregate, 3,233 kilometers or 2,009 miles.	

THE SCRAP HEAP.

Traffic Notes.

It is reported that the Wabash road, after paying employees by check for a long time, will resume the use of the pay car.

The Buffalo, Rochester & Pittsburgh has voluntarily advanced the pay of locomotive firemen. It is said that the advance amounts to 10 per cent.

for men on passenger trains and 14 per cent. for those on freights.

A special newspaper train was run over the New York, New Haven & Hartford from New York to Boston on Sunday morning, April 8, in 4 hours 23 minutes. The train traveled over the Air Line Division, by which route the distance is 213 miles.

Press reports state that an order has been issued by the Minnesota Railroad Commission directing the Chicago, Milwaukee & St. Paul to change its narrow-gauge line, known as the Wabasha and Preston Divisions, from narrow gauge to standard gauge. It is said that the road will decline to comply, as the change would involve considerable expense without any appreciable advantage.

Traffic Notes.

The Union Pacific announces that on and after April 22 it will run two through trains daily between Chicago and Portland.

A freight bureau has been organized by the shippers of Joplin, Mo. The Chairman is J. F. Dunwoody and the Secretary is J. E. Pearson.

During the month of March 15,473 interchangeable 1,000-mile tickets were sold on the Central Passenger Association lines. This is 1,857 more than were sold in March, 1899.

The newspapers report that the Pennsylvania and the Reading have made an agreement not to run any trains between New York and Philadelphia in less time than two hours.

The receipts of grain at Chicago in the month of March were 21,958 cars. This is a slight decrease from February, but it is larger than the record for March in any year since 1890. The roads leading east from Chicago have lately been unable to furnish cars as fast as they were wanted.

New York papers report that Mr. Edward F. Cragin has secured rights to riparian property in New York Bay between Liberty and Ellis islands, where the water is very shallow, and that he proposes to put up large storehouses and elevators for transferring grain directly from cars to ocean steamships. The situation is convenient for a connection with the Central Railroad of New Jersey.

The Supreme Court of Texas has decided that one railroad need not switch cars for another to the detriment of its own business. The Gulf & Interstate tried to compel the Texas & New Orleans to receive cars from the G. B. & K. C. at Beaumont and deliver them to the G. & I., about one mile, offering to pay \$2.50 a car. The T. & N. O. refused, on the ground that it had a line of its own from Kirbyville, whence this freight was shipped, to Galveston, its destination.

A hearing was given by the Senate Committee April 6 on the bill amending the Interstate Commerce law. Mr. Geo. R. Blanchard appeared and opposed the bill. He ridiculed the efficiency of the Commission and argued generally in favor of freedom of action by the railroads without Federal supervision. He declared that the provisions of the Interstate Commerce Act were all antagonistic and none remedial, and that it did not create nor foster that mutual interest between Government and carriers essential to success. The act, he said, did not recognize the palpable fact that ten different rates on ten railroads were as disturbing and discriminating to commerce as ten rates on one road, and that the poorest or richest can make the competing rates for the other roads. Mr. Blanchard declared that the law is inadequate and harmful to the largest industrial interests of the country, and that it gives power which is not given to any State or National railroad commission in the world. Chief Assistant Attorney Hines, of the Louisville & Nashville, followed Mr. Blanchard.

N. Y. C. Engineers' Excursion.

A party of locomotive engineers of the New York Central, consisting of about 50 men and their wives, are making a tour to the Pacific Coast and back, 7,400 miles, by special train. They left Buffalo March 20 and are due to reach that city on their return April 21. The journey is made over the Lake Shore, Big Four, Illinois Central, Southern Pacific, Rio Grande Western, Denver & Rio Grande, Union Pacific, Chicago & Northwestern and Michigan Central. These railroads all give free service, but it is not true, as has been stated, that the New York Central pays the party's expenses. The itinerary for this excursion is one of General Passenger Agent Daniels' most fetching folders, with pictures of New York Central buildings, locomotives and scenery. With this folder, and the skillful services of the press agent of the excursion, who "works" the local newspapers in the cities along the route traversed, the Central will get a first-rate advertisement, and the engineers really ought, this month, to be put on the payroll of the passenger department.

Great Floods in Texas.

On the morning of April 7 the great dam across the Colorado River, four miles above Austin, Tex., was partially broken down by a flood, and much damage to property was done in Austin and vicinity, and all the way to the mouth of the river, 300 miles. Dwellers in the river bottoms were mostly notified in season to escape, but a number of lives were lost in Austin, and it is estimated that altogether more than 50 persons were drowned, though as yet the figures are far from complete. The dam, built seven years ago, was about 1,000 ft. long and about 40 ft. high in the middle. The failure was occasioned by a great flood in the river, the depth of water flowing over the top of the dam just before the break having been about 10 ft.; and a large crowd of people were watching it at the time. It is said that on the subsidence of the water the first thing noticed by the observers was a large section of the dam near the center, which had been moved bodily down stream a distance of about 40 ft. Another section near the eastern shore had been similarly moved; and between these two there was a gap of about 100 ft., where the dam had entirely disappeared. The City Water Works and electric light plant near the dam, worth \$600,000, were destroyed. The other buildings carried away appear to have been mostly cheap wooden structures.

Press dispatches on the day after the flood reported that the town of Bastrop was surrounded by

water. Railroad traffic was suspended all over the southern half of Texas.

Floods in Concho, McCulloch and Coleman counties, north of Austin, did great damage to the farmers and ranchmen, and thousands of head of cattle were drowned. Many wagon bridges across the river between Austin and Columbus were destroyed. Most of these bridges were new, having been built after the destructive flood of last year.

Strike on Chicago City Railway.

About 100 men employed at the four power houses of the Chicago City Railway struck on Friday evening, April 6, and tied up about 170 miles of electric road and crippled the whole system, of which 24 lines were affected. The trouble was caused by an order of General Manager McCulloch changing the working day at two power houses from 8 to 12 hours. The change cuts down the number of men from 23 to 19 and the daily wages from \$41 to \$40.85, but raises the average wages per man from \$1.80 to \$2.15. The men object to the extra hours and claim that while the hours are increased 50 per cent., the wages are increased only 12½ per cent. The company succeeded in getting men to take the places of the strikers, and by Sunday was giving almost the usual service. It is said that the strikers did not belong to any labor organization.

The Power Canal at Sault Ste. Marie.

It is reported from Washington that the Lake Carriers' Association and the Michigan & Lake Superior Power Co. have reached an agreement regarding the new power canal at Sault Ste. Marie and that a bill has been submitted to the House Committee on Rivers and Harbors. The new power canal is to cost about \$7,000,000, of which it is said about \$3,000,000 has been spent already. The Lake Carriers' Association has feared that the canal would lower the levels. Representatives of the power canal offered to build compensating works on the Canadian shore. The bill as agreed upon gives the power company the right to divert the waters of St. Mary's River into its canal and to construct suitable works on the canal, on condition that the proposed compensating works be provided. It is also provided that the Secretary of War shall appoint a board of five engineers, three to be U. S. Army engineers, and two experienced hydraulic engineers from civil life, to whom shall be referred the plans for the construction and operation of the canal and compensating works.

The Chicago Bridges.

The Chicago River Improvement Association claiming to represent \$75,000,000 worth of property along the Chicago River, last week petitioned the Chicago Sanitary District to take immediate steps to remove the center pier bridges. This petition and other pending resolutions relating to the improvement of the river were referred to the Engineering Committee for consideration this week.

Mr. T. T. Johnston has been appointed to represent the Drainage Board on the Commission to prepare rules to govern navigation on the Chicago River.

Change of Storage Battery System to Overhead Electric.

The motive power of the Chicago Electric Traction Co. will be changed from the storage battery to the overhead trolley system, the work to be done as rapidly as the new equipment can be installed. This road, which for some time has been the only road worked exclusively by storage batteries in this country, was first known as the Englewood & Chicago. It is the only storage battery road in that city, and the typical road of its kind in this country. The storage battery system was installed three years ago and is said to have been a success on single lines, although more expensive than the overhead trolley. Since the road has built extensions and branch lines, however, the system has proved complicated and expensive on account of the mechanical difficulty of recharging the batteries in cars on branch lines which do not run to the central power house. Experiments with sub-stations on the general plan of those used for charging automobiles have proved too expensive and the weight of the cars is said to have affected the track, although the line is almost perfectly level.

A Double-Deck Ferry Boat for the West Shore Railroad.

A double-deck screw ferry boat named the "West Point" is being finished at Hoboken, N. J., for the Weehawken Ferry of the West Shore R.R. Other boats now building for the New York Central are a large steam lighter, two ocean-going tugs, several car floats, steam hoisting barges, and a number of covered barges and grain boats. The N. Y. C. & H. R. R.R. Co.'s new pier at the foot of Watts St. (Pier 31, North River) is finished and will be opened about May 1. This pier adjoins the Desbrosses St. Ferry of the Pennsylvania R.R., and is 840 ft. long and 60 ft. wide. Contracts have been let for the new flour pier at the foot of Broad St., New York City.

Pig Iron in Great Britain in 1899.

The Iron and Coal Trades Review shows that the total make of pig iron in the United Kingdom in 1899 amounted to 9,305,319 tons, an increase of 624,248 tons over the previous year. No record is available as yet of the total quantity of iron ore consumed in the United Kingdom in 1899. But the total volume of iron ore imports was 7,055,178 tons, which is an increase of 1,537,000 tons on the corresponding imports for the year 1898. The total stocks of pig iron in the hands of makers at the end of the year 1899 were extraordinarily low, amounting to only 192,396 tons. The stocks in public stores in Scotland, Cleveland and West Cumberland amounted to a further total of 523,321 tons. The total stocks under both heads reached 720,717 tons. The average number of furnaces in blast and out of blast during the year 1899 was, in blast, 409; out of blast 187. Twelve new furnaces were being built and 53 furnaces were being rebuilt at the end of 1899.

The Boss of the Wrecking Gang.

A mechanical officer, that is to say, a superintendent or foreman from the locomotive or car shops, rather than a trainmaster or a roadmaster, is the most suitable person to take charge of clearing up a wreck on a railroad. This is the conclusion of a paper which was read by Mr. George W. Bartlett, Superintendent of the Dunkirk, Allegheny Valley & Pittsburgh, before the Buffalo Railroad Association last month. Mr. Bartlett described in detail the qualifications of these three different classes, and showed that the experience of the mechanical man in

handling heavy masses, in using ropes and cables, jacks and other lifting appliances, gave him an unquestionable advantage over any railroad officer who lacks this experience. Before writing his paper Mr. Bartlett consulted trainmasters and roadmasters. He found that the trainmaster thought a trainmaster would be the only suitable boss for this kind of a job; while the roadmaster was equally sure that the only right choice would be to take a roadmaster; but the speaker stuck to his original view.

A Third-Rail Electric Road in England.

The Mersey & Wirral Railways (England) have finally resolved upon the working of the line by the third-rail electric system, this decision being reached after hearing reports prepared by Sir W. H. Preece and Major Cardew. The chief point which has appealed to the Mersey Company seems to be the fact "that electric traction has the advantage of enabling the train to be adjusted to the number of passengers that has to be carried, thus making a reduction in working expenses possible." It is estimated that there will be a saving in working expenses of \$55,000 to \$60,000, and the increase in the receipts at once will be \$90,000.

Report on a Broken Tap.

A tool of this kind requires careful handling to prevent the thin teeth from over-heating and from heating irregularly. The trouble in this case is that the tap has been both irregularly heated and over-heated. It was not hard on the first few rows of teeth, while the last rows were all chipped off. These chipped teeth show a very coarse grain, indicating that this portion of the tap had been heated to almost a yellow heat, while the other end (of the cutting portion) had not been heated high enough to harden properly. We have rehardened the tap and fractured it to show the condition of grain when heated through and to a uniform heat, and have returned it to you by express. It hardened at just a good, full, red heat, in water. An even heat and a low heat, the lowest at which the steel will harden, will bring the taps out with a fine, even and strong grain, this condition of structure being essential in the hardened tool to give good performance.—Sparks.

A Long and Short Haul Decision.

The Interstate Commerce Commission, in an opinion by Commissioner Clements, has rendered its decision in the case of the Board of Trade of the City of Hampton, Fla., against the Nashville, Chattanooga & St. Louis, the Central of Georgia and the Georgia Southern & Florida. Rates from St. Louis, Nashville and Chattanooga to Hampton are combinations of the through rates through Hampton to Palatka and from Palatka back to Hampton, and merchants at Palatka can compete with merchants at Hampton at their own doors on equal terms. This system of rate-making results in one of the principal evils which the Act to Regulate Commerce was designed to remedy. While the location of Palatka on the St. Johns River, and the fact that there is more competition by rail at Palatka than at Hampton may justify rates somewhat lower than to Hampton, the difference is too great; the carriers are bound to take into account the interest of the community at Hampton as well as its own interest, and they must not put in rates to Hampton which prohibit its citizens from the transaction of business in competition with Palatka.

Held, that the present Hampton rates are in violation of both the fourth and third sections of the Act to Regulate Commerce, but that Hampton rates may properly be made higher than the Palatka rates by the differentials now existing between the Palatka and Jacksonville rates.

British Trolley Lines.

The system of trolley cars established nearly two years ago between Middlesbrough, Stockton & Thornaby, and described in the Railroad Gazette at the time, has worked with great success during the year 1899, the number of passengers carried in the year being 8,307,322. The gross receipts were \$45,372, and the net profit \$14,611, representing nearly 62½ per cent. upon the capital.

The London United Tramway Co., which is equipping 30 to 40 miles of electric tramways in West London, many miles on the double trolley system to avoid leakage effect upon magnetic observatories in the neighborhood, is nearing the completion of its first 10 miles, and it is expected that the opening will be coincident with the opening of the Central London Railway, which touches the West London tramways at Shepherd's Bush. The company dispensed with contractors for erection and equipment and took the whole work into its own hands. The first 150 cars, as a first instalment, are approaching completion.

The Norwich city trolley lines are especially interesting by reason of the fact that the city, although so large, has never yet had any tram service. The new lines are owned by the Norwich Electric Tramways Company, and 19 miles of permanent way are now ready. It is expected to have the whole system working by the end of April.

Railroad Disaster in Russia.

A press despatch from Vladikavkas, Southeastern Russia, March 31, reports a collision between a passenger train and a freight, which was followed by a great fire, due to the presence of tank cars of petroleum in the freight train. A number of employees and passengers were burned to death.

Lake Note.

Mr. A. B. Wolvin, of Duluth, has let contracts to the American Shipbuilding Co. for four or six steel vessels, part of which will be barges. These contracts are the first to be let for new vessels since last fall, and the boats are to be finished by next fall. The vessels will be small enough to run through the Canadian canals, or a little less than 250 ft. long, with a capacity of 75,000 bushels of wheat; and they will have machinery suitable for ocean service, including condensers. The engines will be placed amidships. It is said that a company has been organized to run boats from Duluth to Montreal.

The Recalescent Point.

I agree with you that the point of recalescence is not constant even in pieces taken from the same bar, or in the same piece when heated the second time. I have detected a difference of 17 deg. C. in heating the piece a second time. There is no question in my mind but that the conditions are governed somewhat by the magnetic properties.—Sparks.

British Compressed Air Tramways Company, Limited.

This company was registered on Jan. 8, by Ashurst & Company, 17 Throgmorton Avenue, E. C. Capital, £75,000, in £1 shares. The signatories are: A. D. Brown, 31 Reighton Road, Upper Clapton, N. E.; E. Wyatt, Bangor House, Lausanne Road, Hornsey, N.; A. J. Swan, 20 Marsden Road, E. Dulwich; E. G. Church, 80 Leander Road, Brixton Hill; R. A. Stebling, 6 Penford Street, Camberwell; T. E. Goss, 6 Great Woodstock Street, W.; P. E. Harris, 34 Walcott Square, S. E.—Compressed Air.

Technical Schools.

University of Illinois.—Prof. I. O. Baker, head of the department of Civil Engineering, delivered a lecture before the students of the College of Engineering on April 4, on "The Distinguishing Characteristics of American Engineering."

Of the 507 graduates of the College of Engineering, the latest reports show that 457 are engaged in some branch of engineering work.

On April 10, Mr. F. H. Newell, Hydrographer of the U. S. Geological Survey, delivered a lecture at the University on "Hydrographic Work in the United States Geological Survey." Mr. Newell described the special investigations which have been made during the past ten years on the hydrography of the country, the lecture being illustrated by lantern slides showing maps, diagrams of river flow, plans of irrigation, noted dams, and canals. Mr. Newell has made a specialty of this branch of the work of the Geological Survey, especially with reference to the water power of the United States.

Massachusetts Institute of Technology.—Dr. Henry S. Pritchett, now Chief of the U. S. Coast and Geodetic Survey, has been chosen President of the Massachusetts Institute of Technology, succeeding Dr. Crafts, resigned. Dr. Pritchett was born April 26, 1857, at Fayette, Mo. He worked under Prof. Asaph Wall in the U. S. Naval Observatory and later took the degree of Ph. D. at the University of Munich. After further experience in the Naval Observatory and as astronomer of the Morrison Observatory he became Assistant Professor of Mathematics and Astronomy at Washington University, St. Louis, and later Professor. Thence he went to be Chief of the Coast and Geodetic Survey. He had been 16 years at Washington University, during which time he had made a number of astronomical expeditions abroad. Prof. Silas W. Holman, Professor Emeritus of Physics at the Institute, died April 1.

LOCOMOTIVE BUILDING.

The Burmah State Rys. are said to have asked bids on 20 more locomotives.

The St. Louis Southwestern on April 5 ordered six more locomotives from the Rogers Locomotive Co.

The St. Lawrence & Adirondack is having two locomotives built by the Schenectady Locomotive Works.

The St. Louis & San Francisco has ordered 18 consolidation engines, with 21 in. x 28 in. cylinders, from the Dickson Locomotive Works. The road has not ordered 20 engines from the Baldwin Locomotive Works, as stated by a contemporary.

The Great Northern of Canada expects, on April 13, to place an order with the Baldwin Locomotive Works for four compound freight and four simple passenger engines. James McNaught, 35 Nassau St., New York City, expects to leave for Philadelphia on that day to close the contract. The road has already bought six engines, three of which were practically new.

The Cleveland, Cincinnati, Chicago & St. Louis has ordered 15 simple consolidation freight engines from the Brooks Locomotive Works. They will weigh 138,000 lbs., with 170,000 lbs. on the driving wheels, and have 22 in. x 30 in. cylinders; 58-in. driving wheels; extended wagon top type of boilers, with a working steam pressure of 200 lbs.; and a tank capacity for 6,000 gals. of water.

The Monongahela Connecting order with the Pittsburgh Locomotive & Car Works for two four-wheel switching engines, referred to last week, calls for Sept. 1 delivery. The engines will weigh about 92,000 lbs. and have 18 in. x 24 in. cylinders; 52-in. driving wheels; boilers with 202 charcoal iron tubes 2 in. in diam. and 11 ft. 6 in. long; working steam pressure 160 lbs.; fireboxes, of homogeneous steel, 58 in. long and 34½ in. wide, and a tender capacity for 3,000 gals. of water. The engines will be equipped with steam brakes, No. 8 Monitor injectors, Jerome piston and valve rod packings, Ashcroft safety valves, No. 8 Nathan lubricators, Crosby steam gages, Latrobe driving wheel tires and Homestead blow-off cocks.

The Illinois Central passenger engines referred to last week will weigh 149,700 lbs., with 116,800 lbs. on the driving wheels, and have 19½ in. x 26 in. cylinders; 69-in. driving wheels; Belpaire boilers with a working steam pressure of 200 lbs. and 264 tubes of special material, 2 in. in diam. and 13 ft. 5½ in. long; fireboxes, of Carbon steel, 122½ in. long and 32½ in. wide; and tender capacity 5,000 gals. of water and 10 tons of coal. The special equipment will include Heggibottom bell ringers, Little Giant pneumatic blow-off cocks and Nutting smoke burners; the switching engines will weigh 118,900 lbs. and have 19 in. x 26 in. cylinders; 51-in. driving wheels; straight top boilers, with radial stays, a steam pressure of 165 lbs. and 220 tubes of special material 2 in. in diam. and 11 ft. 7 in. long; fireboxes, of Carbon steel, 112 in. long and 33½ in. wide; and a tender capacity for 3,000 gals. of water and 5½ tons of coal. These will also have Nutting smoke burners. The other special equipment for the passenger and switching engines will be the same as for the freight engines described last week.

CAR BUILDING.

The Mobile & Ohio is reported considering buying 200 box cars.

The Mather Stock Car Co. is reported considering buying 200 box cars.

The Southern Missouri & Arkansas has ordered 50 box cars from F. M. Pease.

The Minneapolis & St. Louis is reported as figuring on some new freight cars.

The Terre Haute & Indianapolis is having one passenger car built by the Pullman Co.

The Wheeling & Lake Erie is having one special car built by the Barney & Smith Car Co.

The Republic Iron & Steel Co. has ordered 20 coal cars from the American Car & Foundry Co.

The Pennsylvania is having one passenger car for special service built by the Pullman Co.

The Shreveport & Red River Valley is considering buying 60 box and 40 low side gondola cars.

The Michigan Central has bought materials for 200 furniture cars to be built at its own shops.

The Duluth, Missabe & Northern has bought 20 box, two stock and nine flat cars from F. M. Pease.

The Freedom Oil Works Co., of Freedom, Pa., has ordered 10 cars from the Youngstown Car Mfg. Co.

The St. Louis Smelting & Refining Co. has ordered eight dump cars from the American Car & Foundry Co.

The Continental Fruit Express has ordered seven refrigerator cars from the American Car & Foundry Co.

The Kelly's Creek Mining Co. (W. Va.) has ordered 20 coal cars from the American Car & Foundry Co.

The St. Paul & Duluth has ordered 50 flat cars of 80,000 lbs. capacity from the American Car & Foundry Co.

The Charlotte Oil & Fertilizer Co. is having five cars built at the Milton works of the American Car & Foundry Co.

Rogers, Brown & Co., of Chicago, are reported in the market for 1,000 box cars. The company denies the report.

The Choctaw, Oklahoma & Gulf order for freight cars referred to last week we are informed will not be given at present prices.

The St. Louis & San Francisco has issued specifications and asked bids on from 200 to 500 box cars, which we have previously noted.

The National Rolling Stock Co. is having 300 cars built at the Milton works and 40 cars at the Huntington works of the American Car & Foundry Co.

The Pere Marquette on April 10 received bids on 200 coal cars of 60,000 lbs. capacity. The road was considering buying 200 gondola and 200 drop bottom coal cars.

Private interests identified with the Cleveland, Cincinnati, Chicago & St. Louis are getting prices on 125 box cars to be built from old Cleveland, Cincinnati, Chicago & St. Louis specifications.

The Atlantic, Valdosta & Western has ordered 100 flat and 30 box cars from the Georgia Car & Mfg. Co. and has practically closed a contract with the same works for 120 more cars of the same classes.

The Detroit & Mackinac will order 150 coal cars of 80,000 lbs. capacity. The contract will probably be given to the Barney & Smith Car Co. The road is having four passenger cars built by Barney & Smith.

The Great Northern of Canada, through James McNaught, 35 Nassau St., New York City, was about to award a contract for 350 box cars of 60,000 lbs. capacity as we were going to press. He has also bought for the road 241 freight cars from Armour & Co. and others, and expects to buy 100 cars from the Wisconsin & Michigan RR. Some passenger cars will also be ordered, as previously noted.

The International & Great Northern in March ordered from the American Car & Foundry Co. 350 box cars of 60,000 lbs. capacity, as noted in our issue of Mar. 30. These cars will be 34 ft. long, inside, 8 ft. 3½ in. wide and 7 ft. high, and will weigh about 30,000 lbs. They will be equipped with Westinghouse air brakes, Phosphor-Bronze brasses, Tower couplers, American continuous draft rigging, Pickering springs, American Steel Foundry Co.'s cast steel trucks; Western Railway Equipment Co.'s brake adjusters, doors and door fastenings; metal roofs, iron axles, cast iron brake shoes, malleable iron journal boxes and lids, and wood dust guards.

BRIDGE BUILDING.

ALBANY, B. C.—Bids are wanted until noon of April 18 for a bridge across the Sprout River near this place. W. S. Gore, Deputy Commissioner of Lands & Works Department, Victoria, B. C.

ALLEGHENY, PA.—The Allegheny Common Council is considering a bridge at California Ave. over the Ohio River.

ANACONDA, MONT.—The Board of Trade at its next meeting will consider a new bridge across the Missoula River.

BENNINGTON, VT.—The Bennington & Rutland RR. proposes to replace all the wooden bridges with steel structures.

BELLEFONTAINE, PA.—The new bridge proposed over the Logan Branch will be a low truss 58 ft. wide, and have 8-ft. sidewalks on each side. The borough is to pay part of the cost and the county the remainder.

BOSTON, MASS.—The plans for the proposed bridge over the Charles River in place of the old West Boston bridge between Main St., Cambridge, and Cambridge St., Boston, are being prepared and it is expected that within a few weeks a general plan will be submitted to the Commission.

BRIDGEPORT, CONN.—A committee has been appointed to consider building a bridge over Yellow Mill Pond. About \$80,000 is available.

CANTON, O.—Stark County will sell \$38,000 of 4 per cent. bridge bonds on April 14. W. M. Reed, County Auditor.

CLEVELAND, O.—The Polk County RR. will need two bridges about 200 ft. long. F. M. Stearns, President.

COLUMBUS, O.—The New Columbus Bridge Co. has the contract for the superstructure of the Goodale St. bridge at \$24,715. The substructure is let to F. M. Townsend, at \$29,522. The contract for the approaches is let to Foley Bros. at \$12,292.

DAYTON, O.—Bids are wanted until April 28 for a 125-ft. bridge over the Little Twin Creek. A. G. Feight, County Auditor.

DENVER, COL.—The Board of Public Works is considering the proposed viaduct on West Colfax Ave. It is proposed from Seventh St. in West Denver to Elliot St., North Denver. The approximate cost is estimated at \$700,000.

EAST HAVEN, CONN.—The plans for a draw-bridge between Branford and East Haven over Stony River have been sent to the Secretary of War.

ELKTON, MD.—A new bridge across the Sassafras River, which separates Cecil and Kent counties, is under consideration by the Commissioners of the two counties.

FRANKFORD, IND.—Bids are wanted for several steel bridges, according to report, until April 16. Frank B. Elliott, Chairman County Commissioners.

GUTHRIE, O. T.—The County Commissioners have been petitioned for a bridge over the Cimarron River on the county road, at a place called Iowa City.

HAVERHILL, MASS.—A bridge will be needed for the elimination of a grade crossing. Robert R. Evans, City Engineer.

LA MOURE, N. D.—C. J. Allister, County Auditor, received 12 bids for the two combination bridges to be built over the James River. The contract was let to the Hewett Bridge Co. of Minneapolis, Minn., for both. (March 2, p. 143.)

LIVINGSTON, TENN.—The Indiana Bridge Co. has a contract for a steel bridge over Spring Creek, Overton County.

LOCKPORT, N. Y.—The bill appropriating \$75,000 for a steel bridge over the Erie Canal at Pine St. in Lockport has passed the Assembly.

NEWARK, N. J.—The Pennsylvania RR. will build a bridge over the Passaic River for a new line now building across the meadows.

NEW BEDFORD, MASS.—A bill is before the Massachusetts Legislature to authorize a bridge between New Bedford and Acushnet.

NEW YORK, N. Y.—A hearing was given by the Mayor April 9, on the bill for widening the bridge which is to be built over the Harlem River at 149th St. The bridge as proposed and for which the contract has been let to John C. Sheehan for \$1,100,000, is to be 57 ft. wide. A bridge 100 ft. wide is wanted.

OMAHA, NEB.—It seems probable that the viaduct to span the tracks of the Union Pacific and the C. B. & Q. on Central Boulevard will be built. The total length of the viaduct is to be 600 ft., half of which will be approach.

A conference will soon be held by the City Engineer and railroad representatives relative to the viaduct at Twenty-fourth St.

PARKER, S. D.—Bids are wanted for a bridge in Salem Township until April 26. Joseph P. Graber, County Auditor.

PARRY SOUND, ONT.—It is proposed to build a steel bridge across a river at this place, replacing a wooden structure.

PHILADELPHIA, PA.—Wm. C. Haddock, Director, Department of Public Works, received the following bids for a bridge over Pennypack Creek on Rhawn St.:

John Dazley Iron Works, Philadelphia.....	\$54,351
Hoffman Engineering & Construction Co., Phila..	54,900
Richard Walsh, Wissinoming, Pa.....	56,537
Armstrong & Printzenhoff, Philadelphia.....	57,500
P. McManus, Philadelphia.....	58,500
Philadelphia Construction Co., Philadelphia.....	64,800
Michael O'Rourke, Philadelphia.....	65,000
Harmer & Quinn, Philadelphia.....	71,273
David Peoples, Philadelphia.....	89,900

PORTAGE LA PRAIRIE, MAN.—The iron bridge proposed over the Assiniboine River by the Provincial Public Works Department will be 400 ft. long. It will consist of three spans on concrete abutments and piers. Geo. A. Simpson, Chief Engineer of the Department, Winnipeg, Man.

PORT HURON, MICH.—We are told that there is no truth in the report that the Pere Marquette will build a bridge over the Black River at this place.

QUINCY, MASS.—A bill is before the Massachusetts Legislature providing for a new bridge over the Weymouth Fore River between Quincy and Weymouth.

ST. PAUL, MINN.—The bridge proposed over the Mississippi River at this place is by the South St. Paul Belt Ry. Co., which has a bill before the Legislature for it. If permission is granted, the work will be done next winter.

SAN ANTONIO, TEX.—Reports from this place state that a flood destroyed two bridges on the International & Great Northern between Taylor and Austin; also a bridge on the Kerville Branch of the Arkansas Pass RR. over the Guadalupe River; also the Cibola River bridge on the Gulf Shore road.

SPRINGFIELD, MASS.—A new bill for the bridge over the Connecticut River between Springfield and West Springfield has been presented to the Legislature.

The selectmen have decided to have two overhead plate girder bridges in place of the three grade crossings now in use on the Boston & Albany.

TERRE HAUTE, IND.—The City Council has voted against building a viaduct on Ohio St., on the petition of the Evansville & Terre Haute RR.

THERMOPOLIS, WYO.—A \$12,000 steel bridge is proposed at this place.

THORNTON, N. M.—The Cochiti & Northwestern Ry. will need one bridge over the Rio Grande River, with a span of 500 ft.; also a bridge of 200 ft. over the Rio Santa Fe. About 200 ft. of trestle will also be required. (See Railroad Construction column.)

UTICA, N. Y.—A steel lift bridge will be built by the Department of Public Works over the Erie Canal at Washington St.

WACO, TEX.—Morgan H. Rhodes, of Waco, Tex., has contracts for the following bridges in Texas:
 2 bridges of two spans 60 ft. each, in Orange Co. \$9,000
 1 bridge with 122 ft. draw span each, in Orange Co. 4,300
 1 bridge with 150 and 75 ft. span, in Colorado Co. 4,300
 1 " " 75 ft. span, in Milan Co. 1,300
 1 " " 300 and 60 ft. span, in Robertson Co. 1,800
 2 bridges with 50 ft. spans each, in Taylor Co. 2,100
 1 bridge with 100 ft. span, in McLennan Co. 2,100

WARSAW, IND.—Bids are wanted, according to report, until April 19 for three county bridges. N. Y. Chamberlain, County Engineer.

WAUTOMA, WIS.—The taxpayers have voted to build a bridge across the mill pond at a cost not to exceed \$12,000.

WESTBROOK, ME.—A bridge is proposed over the Presumpscot River, according to report.

WHARTON, TEX.—The Bridge Department of the Southern Pacific will build a bridge over the Colorado River near this town for the New York, Texas & Mexican RR. Co. It will be of iron, 200 ft. between centers of end pins and cost about \$20,000.

WINSLOW, ME.—A bridge, probably of steel and 180 ft. long, consisting of three spans, one 100 ft. long and two 40 ft. each, is proposed over Mile Brook. The town has appropriated money for part of the work. C. E. Warren, member of the Committee; J. D. Bassett, Town Clerk.

YANKTON, S. D.—Joseph Geisler, of Sioux City, S. D., is reported to have secured control of the Yankton Bridge & Ferry Co., and will build a bridge across the Missouri River at this place.

Other Structures.

BELOIT, WIS.—M. E. Stevens of Beloit has the contract for building the new passenger station and the freight depot of the Chicago & Northwestern in this city. The two buildings will cost \$30,000.

COLUMBUS, GA.—The Central of Georgia has under consideration a number of improvements at Columbus. The union station will probably be rebuilt.

DERBY, CONN.—It is reported that the New York, New Haven & Hartford, among improvements proposed on the division in the Naugatuck Valley, will build new stations at Derby, Ansonia, and at Waterbury.

LEBANON SPRINGS, N. Y.—The Chatham & Lebanon Valley RR. is having plans made for a new station at this place.

MARSHALL, TEX.—The Texas & Pacific proposes to spend about \$50,000 on car shops at this place. The main building will be 500 x 125 ft. The wood-working and painting shop will be 400 x 100 ft. The blacksmith shop, boiler and engine room, etc., will be 300 x 100 ft. All the structures will be of brick and work is to be begun in about 30 days.

MASSILLON, O.—The Massillon Iron & Steel Co. has finished a plant to make cast-iron water pipe and fittings, consisting of a main building, 250 x 100 ft., with machine shop, pattern shop, power house and miscellaneous buildings. The company will make a specialty of heavy jobbing castings in green sand, dry sand and loam, and do a general engineering business in connection with making cast iron pipe. The officers are: C. M. Russell, President; F. F. Fisher, Vice-President; H. A. Croxton, Secretary and Treasurer; W. W. Wainwright, Superintendent.

MERIDIAN, MISS.—The Mobile & Ohio has bought land at this place on which a \$60,000 freight depot will be built.

MONTREAL, QUE.—James Stewart & Co., contractors of St. Louis, Mo., have a contract to build for the Connors Syndicate, of Buffalo, N. Y., two elevators with warehouses, one of 1,000,000 bushels capacity at Port Colborne, the other of 1,500,000 bushels at Montreal. The piers of the elevators will be of stone; the first story will be of steel, the walls and what is usually termed the crib will be veneered with brick. The cupola will be entirely of steel and the floors fireproof. The bottom of the bins will be covered with fireproofing and all of the spout and interior work will be of steel. The warehouses will be of brick. The plans were prepared by Barnett & Record of Chicago.

NEW YORK, N. Y.—Edward F. Cragin, of 71 Broadway, has a lease from the New Jersey Riparian Board for land under water between Bedloe and Ellis islands, New York Harbor, about 2,200 ft. x 800 ft., to be used as a site for extensive grain elevators. A company is being organized.

The New York Central & Hudson River has let a contract for a new flour pier, 550 ft. long x 70 ft. wide, at the foot of Broad St., New York.

PITTSBURGH, PA.—The Carnegie Steel Co. will soon begin work on a new mill at Duquesne which will cost \$1,000,000. The mill is to be used for making steel for agricultural implements and general merchant trade. The main building will be 600 ft. long and 150 ft. wide. It will be near the Oliver Station.

SARATOGA, N. Y.—Conrad Schroeder, of Scranton, Pa., has a contract for the new Delaware & Hudson depot at this place. It will be 400 ft. long and 28 ft. wide. It will be of iron and brick and have a slate roof, and cost about \$50,000.

TOLEDO, O.—Three new buildings are to be erected by the Toledo Bridge Co. at a cost of about \$250,000. They will be 600 x 120, 320 x 100 and 150 x 60 ft. in size.

TORONTO, ONT.—The Canada Foundry Company, Ltd., was recently incorporated as successor to the St. Lawrence Foundry Co., and has a capital of \$100,000. A number of improvements are proposed. W. D. Matthews is President.

WEATHERFORD, TEX.—The Texas & Pacific is building a \$30,000 combination freight and passenger station, 40 x 160 ft., at this place.

YORK, PA.—The foundry of the Norway Iron & Steel Co., recently organized, will be 246 ft. long and 80 ft. wide. Other buildings are an annealing house, 220 x 65 ft.; a two-story building 140 x 40 ft.; also

warehouse, machine shop, carpenter shop, etc. The main buildings will be of steel framework. The capital stock of the company is \$200,000. The directors are: Judge W. F. Bay Stewart, D. F. Lafean, Charles I. Nes, John McCoy, J. W. Steacy, H. H. Weber and Charles James. The officers are: President, Charles I. Nes; Vice-President and General Manager, Charles James; Secretary, H. H. Weber; Treasurer, J. M. Smyser; Attorney, Horace Keesey, Esq.

YOUNGSTOWN, O.—The National Steel Co. will add a new continuous 16-in. finishing mill to its plant at this place for which a contract has been let to the Morgan Construction Co. of Worcester, Mass.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Canadian Society of Civil Engineers.

A paper on "Purification of Sewage by Means of the Soil," by Mr. Geo. Janin, A. M. Can. Soc. C. E., was read at the meeting on Thursday of this week.

St. Louis Railway Club.

The annual meeting will be held at the Southern Hotel, at 3 p. m., Friday, April 13. Mr. S. D. Webster will read a paper on "One of the Economies Practiced in Railway Operation not Mentioned in Text-Books on Economics." Discussion of papers and Question Box topics will follow and the election of officers will occur at this meeting.

Society of Naval Architects and Marine Engineers.

It is especially desirable that the papers to be read at the eighth annual meeting in November next should be in print and ready for distribution at least one month in advance. The Council requests members who desire to submit papers or who have suggestions to make in that matter to communicate with the Secretary at their earliest convenience.

Civil Engineers' Society of St. Paul.

At the regular meeting held April 2, Mr. Oscar Claussen opened a discussion on "Municipal Lighting" by presenting a comparative statement in detail of the cost of maintenance of the plants at Chicago, Detroit, Allegheny, and the probable cost for St. Paul, having first in a general way outlined the various systems and recent improvements.

Central Railway Club.

At the March meeting of the Central Railway Club, Professor Victor C. Alderson, Dean of the Technical College of the Armour Institute of Technology, Chicago, addressed the Club on "The Economic Aspect of Technical Education."

Professor L. P. Breckenridge of the University of Illinois will address the May meeting.

Freight Claim Association.

The Ninth Annual meeting of the Freight Claim Association will be held at the Southern Hotel, St. Louis, Mo., Wednesday, May 2. The order of business will consist of the regular routine business of the meeting, including consideration of the reports of the Standing Committee, and any other matters that may be brought before the Association. This being the annual meeting, there will also be an election of officers.

Western Railway Club.

At the next meeting of the Western Railway Club, to be held Tuesday afternoon, April 17, at the Auditorium Hotel, Chicago, there will be presented two committee reports and one paper. One committee will report on the revision of the M. C. B. interchange rules and another will report on the matter of smoke prevention by the various railroads entering Chicago. The paper will be by Mr. J. M. Taylor, General Storekeeper Illinois Central RR., entitled: "Improved Methods and Facilities for Handling and Accounting for Materials at Shops and Storehouses."

The American Railway Association.

The spring meeting of the American Railway Association will be held at the Auditorium Hotel, Chicago, Ill., on Wednesday, April 25, at 11 a. m. Reports will be presented by the following committees: Executive Committee, Committee on Train Rules, Committee on Car Service, Committee on Safety Appliances, Joint Committee on Interlocking and Block Signals, Nominating Committee, Committee on the Metric System, Committee on Statistical Inquiry, and the Committee on Standard Dimensions of Box Cars. The annual election of officers will take place at this meeting.

Officials connected with roads members of the Association may order copies of the Proceedings at 50 cents a copy. The price to others is \$1. W. F. Allen, Secretary, 24 Park Place, New York.

Western Society of Engineers.

On the afternoon of April 4 about 100 members of the Society made a trip around the Union Elevated Loop and over the Metropolitan Elevated. The excursion was arranged and the Society invited by Messrs. S. S. Neff, Superintendent of the Union Elevated, and H. M. Brinckerhoff, Assistant General Manager of the Metropolitan Elevated, to give members of the Society an opportunity to see the working of the interlocking and safety stop devices used on the Loop. The party left the Loop station at Dearborn and Van Buren Sts. at 1:45 p. m. on a special train of two motor cars furnished by the Metropolitan Elevated. Passing around the Loop the train made all the switches, ran by signals, exploded torpedoes and tested all the safety devices on the Loop. From the Loop the train went out over the Metropolitan Elevated, where some quick stops were made from a speed of 35 miles an hour. A stop was made at the car barn to see the trucks and other equipment, and the rest of the afternoon was spent in visiting the very fine power house of the Metropolitan Elevated at Center Ave., which is one of the most complete, both as to equipment and management, of the Chicago power stations.

At the regular meeting of the Society on Wednesday evening, April 4, a paper by Mr. Francis H. Bainbridge, on the "Rebuilding of the Kinnikinnick River Swing Bridge at Milwaukee, Wis.," and illustrated with lantern slides, was presented.

National Convention of Railroad Commissioners.

The Twelfth Annual Convention of Railroad Commissioners will be held at the Pfister House, Mil-

waukee, Wis., on Monday, May 28. The Railroad Commissioners of all States, and State Officers charged with any duty in the supervision of railroads, are invited to attend and participate in the discussions. The Association of American Railway Accounting Officers is also invited, as in past years.

At the last Convention committees were appointed to consider and report to the next Convention on the following subjects:

1. Classification of construction expenses.
2. Classification of operating and construction expenses of electric railways.
3. Railroad statistics.
4. Uniform classification.
5. Powers, duties and work of railroad commissions.
6. Legislation.
7. Delays attendant upon enforcing orders of railroad commissions.
8. Safety appliances.
9. Grade crossings.
10. Plans for ascertaining the fair valuation of railroad properties.

Members of the Convention are requested to suggest other topics to the Committee on Programme: A. W. Cole, Albany N. Y., Chairman; James W. Latta, Harrisburg, Pa.; Charles S. Rannels, Jacksonville, Ill.; Graham L. Rice, Madison, Wis., and E. G. Akers, Richmond, Va.

Questions of unusual importance are likely to be brought up for discussion at the coming meeting.

Cicero J. Lindly, of Illinois, is Chairman, and Edward A. Moseley, of Washington, is Secretary. The date of the Convention is later than that fixed at Denver last year, the change having been found necessary in order to get hotel accommodations.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. C. E. A. Bartlett, Treasurer of the Boston & Lowell (Boston & Maine), died April 4, at his home in Chelmsford, Mass., aged 64 years.

—Mr. F. J. Stout, who recently resigned as General Superintendent of the Wheeling & Lake Erie, has been appointed General Manager of the Toledo, Fremont & Norwalk RR., the proposed electric road in Northern Ohio.

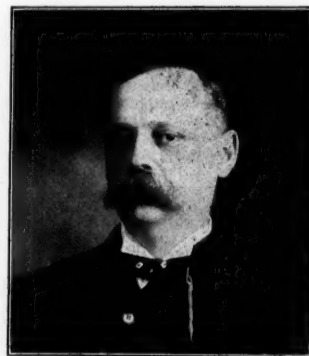
—Vice-President Joseph Ramsey, Jr., of the Wabash Railroad, has been appointed a delegate to the International Railway Congress on behalf of the United States Government. Mr. Ramsey is also a delegate to the congress from the American Railway Association.

—Mr. Joseph T. Richards, Engineer Maintenance of Way of the Pennsylvania RR., sailed for Europe on Wednesday of this week and will be gone about two months. Mr. Richards is accompanied by his wife and daughter and he will spend some time at the Paris Exposition.

—Captain Wm. Sanders Scott, formerly of Philadelphia, has been ordered back to Cuba to take charge of the Sucro & Moron RR., with headquarters at Ciego de Avila. Captain Scott is a practical railroad man, having been for some years in the Transportation Department of the Pennsylvania. For about 18 months he has been on General Wood's staff at Santiago, where he also served on the staff of the late General Lawton. He was appointed a Captain and Assistant Quartermaster in the Army in July, 1898.

—Mr. W. C. Watrous on April 4 became Superintendent of Transportation of the Missouri Pacific. Mr. Watrous was born in 1857 and began railroad service with the New York, New Haven & Hartford in 1880 as stenographer in the office of the General Passenger Agent in New Haven. Three years later he went to Galveston, Tex., with the Gulf, Colorado & Santa Fe. After spending six months with that company he served two years with the Northern Pacific. In 1885 he entered service with the St. Paul, Minneapolis & Manitoba, and continued with that company and its successor, the Great Northern, in the Transportation Department, until 1899. During the last six years of the period he had charge of car distribution. Since Jan. 7, 1899, and until his recent appointment he has been with the St. Louis Southwestern as Superintendent of Transportation.

—Notice has already been made in these columns of appointment of E. P. Bryan as General Manager of the Operating Department of the New York Rapid Transit Subway Co. Mr. Bryan has been connected with the Terminal Railroad Association of St. Louis since 1892. He was born in Ohio, the son of an Episcopalian minister. He entered the service of the Louisville & Nashville in 1865 as a telegraph operator at Lebanon, Ky., and working his way up, was made agent of the company at Frankfort, Ky., and in August, 1891, was appointed Superintendent of the company's terminals at Louisville. In February, the following year, he became Superintendent of the Terminals at St. Louis, which are owned by

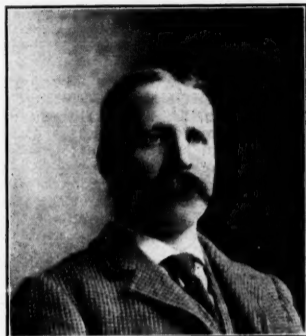


six companies, including the Louisville & Nashville. In December, 1895, he was made Vice-President and General Manager of the same terminals, which position he leaves for his new appointment in New York City.

—Mr. Dwight C. Morgan on March 27 became Engineer Maintenance of Way of the Chicago & Alton, with headquarters at Kansas City, Mo. Mr. Morgan was born at Dwight, Ill., June 5, 1868. After graduation at the University of Michigan, he entered professional service as a rodman on the Cairo Bridge in 1887. He was Assistant Engineer on the St. Louis Merchants' Bridge the following two years, and in

1890 began his first railroad work as Assistant Engineer in locating and building for the Northern Pacific in Montana and Idaho. From 1891 to 1892 he was Assistant Engineer on the Southern Pacific, in the Maintenance of Way and Building Department in California. From 1893 to 1896 he served as Engineer of the Illinois Board of Railroad Commissioners, and during that time was appointed by the U. S. Supreme Court a Commissioner to settle the boundary dispute between the States of Iowa and Missouri, and to permanently mark the same. During 1897 he was Assistant Engineer on the Illinois Central. In 1898 he was in practice as junior member of the firm of Richard P. Morgan & Son at Dwight, Ill. He entered service with the Chicago & Alton as Assistant Engineer in 1899, with which road he still continues.

—Mr. R. H. Bowron, who succeeds Mr. F. H. Britton as Vice-President and General Superintendent of the St. Louis Southwestern at Tyler, Tex.,



was born in England in 1858. He entered railroad service as an operator of the Western Union Telegraph Co., at Pittsburgh, Tenn., in 1877. For three years following 1881 he was in the railroad supply business. From February, 1884, to August, 1886, he was Chief Clerk to the Superintendent of the Alabama Great Southern, and then, until February, 1887, he occupied a similar position with the Mobile & Ohio. For the following five years he was Superintendent of the Chattanooga Union Ry., and for a year until April, 1893, he was engaged in preliminary work for a projected line. From October, 1894, he was with the Montana Central and then with the parent company, the Great Northern, as Chief Clerk to the General Superintendent of the Montana Central until August, 1895, and then as Trainmaster on the same road until December, 1896. With the Great Northern he served as Superintendent of the Montana Division to July, 1897; of the Willmar and Breckenridge divisions until December, 1898, and of the Cascade Division until October, 1899. He then took service as Superintendent with his present company, the St. Louis Southwestern, and was advanced to the General Superintendency in March.

ELECTIONS AND APPOINTMENTS.

Alabama Great Southern.—M. Nicholson has been appointed Assistant Engineer, with headquarters at Birmingham, Ala. Effective April 5.

Canadian Pacific.—David McNicoll, heretofore Assistant General Manager, has been appointed Second Vice-President and General Manager. W. Cross, General Master Mechanic Western Division, is appointed Assistant to the Manager of the Lines West, in charge of the Mechanical Department. C. R. Ord is appointed Master Mechanic of the Western Division.

Central of Georgia.—J. M. Egan, Vice-President, was on April 9 elected President, succeeding H. A. Comer, deceased.

Chicago & Alton.—Thomas H. Hubbard, Engineer Maintenance of Way at Kansas City, Mo., has resigned.

A. Newman has been appointed Assistant General Freight Agent, in charge of Live Stock and Lumber Traffic, and L. Falhorn, Assistant General Freight Agent in charge of the Chicago office.

Chicago & Northwestern.—S. M. Braden has been appointed Superintendent of the Iowa & Minnesota Division.

Choctaw, Oklahoma & Gulf.—C. Robben, Master Mechanic at Argenta, Ark., has resigned.

Clearfield Southern.—The officers of this company are: President, Hon. James Kerr, Clearfield, Pa.; Vice-President, C. D. Simpson, Scranton, Pa.; Secretary, Albert B. Kerr, New York; Treasurer, A. E. Patton, Curwensville, Pa.; and Superintendent, G. C. Shults, Clearfield, Pa.

Cleveland, Cincinnati, Chicago & St. Louis.—Harvey Dodge has been appointed Supervisor of Bridges and Buildings, succeeding Geo. Klump, resigned. The St. Louis Division has been subdivided into three districts instead of two, and C. Wamsley has been appointed Supervisor of the new district.

Cochiti & Northwestern.—The officers of this company, referred to in the Construction column, are: President, James H. Purdy, Thornton, N. M.; Vice-President, Samuel W. Thompson, Disbursing Officer, U. S. Custom House, New York City; Secretary, John S. Thompson, Thornton; General Manager, Joseph E. Gillespie, Thornton; Treasurer, C. J. Bartleson, Thornton; Chief Engineer, H. A. Purdy, Thornton.

Colorado & Southern.—H. Van Mater, heretofore Assistant to the President, has been appointed Assistant Secretary and Treasurer.

Delaware, Lackawanna & Western.—David Brown, who resigned some time ago as Division Master Mechanic at Scranton, Pa., has returned to his old position with the company.

Grand Rapids, Holland & Lake Michigan Rapid.—The officers of this company, referred to in the Construction column, are: President, John Winter, Detroit; Vice-President, Benjamin S. Hanchett, Jr., Grand Rapids; Secretary, Oliver H. Laus, Detroit; Treasurer, Frank C. Andrews, Detroit.

Gulf & Ship Island.—T. W. Geer has been appointed Superintendent of Construction, with headquarters, for the present, at Magee, Miss.

Lake Erie & Western.—Geo. L. Bradbury, Vice-President and General Manager, has resigned, effective May 1.

Little Rock & Hot Springs Western.—F. W. Gregory has been made General Freight and Passenger Agent, with headquarters at Hot Springs, Ark.

Louisiana & Arkansas.—The office of Traffic Manager has been abolished.

Missouri, Kansas & Northwestern.—The officers of this company referred to in the Construction column are: President, Jos. C. Stewart, Webb City; Vice-President, E. O. Bartlett, Joplin; Secretary, R. A. McConnell, Joplin; Treasurer, John E. Murdock, Galena; General Manager, Richard Nevins, Jr., Joplin; General Counsel, O. H. Picher, Joplin.

Missouri, Kansas & Texas.—At a meeting of the stockholders, T. N. Sedgwick of Parsons, Kan., was elected a Director.

New York Central & Hudson River.—A. M. Clough has been appointed Supervisor of Track, Sub-Division No. 21 (River Division), with headquarters at Kingston, N. Y., succeeding R. Brock, resigned.

New York, New Haven & Hartford.—C. M. Ingersoll, Jr., heretofore Assistant to the President, has been appointed Chief Engineer, with headquarters at New Haven, Conn., succeeding F. S. Curtis, recently elected Fourth Vice-President (p. 177).

Pennsylvania.—W. Heyward Myers, Division Superintendent at Harrisburg, Pa., has been appointed Superintendent of the Lewistown Division, with the title of Acting Superintendent, succeeding S. P. Hutchinson, resigned.

Pennsylvania Company.—R. C. Barnard, Engineer Maintenance of Way at Richmond, Va., Southwest System, has been transferred to Cincinnati, O., as Engineer Maintenance of Way, succeeding T. B. Hamilton, transferred. Paul Jones, Engineer Maintenance of Way at Indianapolis, Ind., succeeds Mr. Barnard at Richmond, Va.

Pittsburgh, Bessemer & Lake Erie.—Col. S. B. Dick, Chairman of the Board at Meadville, Pa., has resigned. The new Directors of this company are: J. E. Schwab, T. Morrison, R. A. Franks, A. M. Moreland, D. M. Clemson and James Gayley.

Reading Company.—Charles P. Steele has been elected a Director, succeeding Charles H. Coster, deceased.

St. Louis, Kennett & Southern.—Robert C. Welles has been appointed Auditor, with headquarters at Cape Girardeau, Mo., succeeding Peter Maul, resigned.

Southern California.—W. G. Barnwell has been appointed Assistant General Freight Agent, with headquarters at Los Angeles, Cal.

Southern Pacific.—At the annual meeting of the stockholders held April 4, the following new Directors were elected: John D. Pöbst, succeeding W. E. Dodge; John B. Haggin, succeeding E. H. Pardee; E. F. Searles, succeeding J. C. Stubbs, and Edwin Hawley, succeeding J. Kruttschnitt.

Southwestern Arkansas & Indian Territory.—J. A. Woodson, heretofore Receiver, has been appointed General Manager.

Sunset.—The officers of this company referred to in the Construction column are: President, C. N. Beal; Vice-President, Solomon Jewett; Secretary and Treasurer, H. A. Blodgett; Chief Engineer (pro tem), J. L. Browne. The principal office is Bakersfield.

Tennessee Northern.—H. M. LaFollette has been elected President, succeeding Alfred A. Glasier. J. S. Searles succeeds Mr. LaFollette as Vice-President. R. B. Winkler, Cashier, has been appointed Auditor, and E. T. Warren, Superintendent and General Freight and Passenger Agent, succeeding L. C. Bradley.

Terminal RR. Association of St. Louis.—At a meeting of the stockholders held April 4, Russell Harding, General Manager of the Missouri Pacific, was elected a Director, succeeding W. B. Doddridge, resigned. President M. H. Smith of the Louisville & Nashville succeeds W. S. McChesney, Jr., as a Director of the T. R. R. A. of S. L.

Texarkana & Fort Smith (K. C. & G.).—J. A. Edson has been elected President, succeeding W. S. Taylor; W. L. Estes, Vice-President; J. A. Hanley, Second Vice-President; J. H. Phillips, Treasurer, and F. S. Carroll, Secretary, succeeding J. B. Day.

Wheeling & Lake Erie.—F. J. Stout, General Superintendent, having resigned, the duties of that office will, until further notice, be assumed by the General Manager.

RAILROAD CONSTRUCTION. New Incorporations, Surveys, Etc.

ALBANY & HUDSON RAILWAY & POWER CO.—C. W. Blakeslee & Sons of New Haven, Conn., have the contract for building the third-rail electric railroad from Hudson, N. Y., north to Albany, about 40 miles. The road includes the old Kinderhook & Hudson from Hudson to Niverville. There are 400 men at work. (Aug. 11, 1899, p. 575.)

ARKANSAS NORTHERN.—Surveys are reported completed for this line from Little Rock, Ark., northwest 211 miles to the Missouri State line, and ultimately to Springfield. W. B. Worthen of Little Rock, Ark., is President. (Aug. 13, 1899, p. 588.)

BALTIMORE & LEHIGH.—Work is begun, according to report, in changing this line to standard gauge. (Feb. 23, p. 127.)

BALTIMORE & OHIO.—Contracts are reported let for a branch road to connect the Grafton & Belington Division with new coal fields on the Buchanan River in West Virginia.

BELLINGHAM BAY & BRITISH COLUMBIA.—The Directors have authorized the letting of a contract to J. G. Fairfowl for the first section of the proposed line from Sumas, Wash., southeast 23 miles to Comells. Mr. Fairfowl has contracts on other extensions of the road. (Feb. 2, p. 79.)

CALIFORNIA & NORTHERN.—Surveys are in progress under Frank Herrick, for this recently incorporated line from Eureka, Cal., to run north about 90 miles to Crescent City. Among the incorporators are Charles Nelson of San Francisco, and D. B. Lyman of Reno, Nev.

CALVERT, WACO & BRAZOS VALLEY.—Two extensions of this line are arranged for—one from Calvert, Tex., north about 28 miles to Marlin (March 30, p. 209), and the other from the C. W. & B. V. junction at Lewis Switch south 26½ miles to Bryan (March 23, p. 193). Surveys are nearly completed and building will be begun about April 17. Hugh Burns of Taylor, Tex., has the contract. The work is very light. Maximum grades are 15 ft. to the mile. (Official.)

CANADIAN PACIFIC.—The Honorable Mr. Blair, Minister of Railways in Canada, is reported to have given promise of a subsidy to the Montreal & Ottawa for an extension from Point Fortune northwest about 12 miles to Hawkesbury, Ont.

The Pipestone Branch, according to report, is to be extended 50 miles this season from its present terminus at Antler, N. W. T. (Sept. 29, 1899, p. 685.)

CENTRAL NEW ENGLAND.—The Supreme Court of Connecticut has decided adversely as to right of way for a certain portion of the Tariffville Branch. To complete the road it will be necessary to abandon about three miles of track already built, and to build about 4½ miles more by a circuitous route. (March 23, p. 193.)

CENTRAL OF GEORGIA.—About \$60,000 is to be spent in side tracks at the new cotton factory in Koanoke, Ala.

CENTRAL OF NEW JERSEY.—The Middlebrook Co. has applied to the Supreme Court of New Jersey for the appointment of a commission to condemn the necessary land for its proposed extension from a point on the main line of the C. of N. J., three-fourths of a mile east of Finderne, to run to Chimney Rock, two miles. (Nov. 10, 1899, p. 787.)

Craft & Co., of Bayonne, N. J., are interesting the citizens of that place in a spur down into the city.

CHICAGO, BURLINGTON & QUINCY.—Work is begun, according to report, on the double track line recently incorporated as the Murray & Creston, between Murray, Ia., and Creston, 25 miles. About \$2,000,000 has been appropriated for the work. M. & C., Jan. 26, p. 64.)

CHIPPEWA VALLEY & NORTHERN.—T. J. McGrath, of Green Bay, Wis., is reported to have taken the contract to build 12 miles of this line from Bruce, Wis., on the Minneapolis, St. Paul & Sault Ste. Marie, to run north about 50 miles to Hayward. D. J. Arpin, of Grand Rapids, Wis., is President. (March 16, p. 177.)

CINCINNATI, RICHMOND & MUNCIE.—The Commercial Club of Muncie, Ind., has indorsed the proposition of this company that Center Township grant a subsidy of \$75,000, no part to be paid until the road has been completed from Cottage Grove, Ind., to Muncie. Other conditions are that the road shall be laid with 70-lb. rail; that passenger and freight stations in Muncie be conveniently located and well built; that the general offices shall be located in that city; that building shall be begun before Aug. 1, 1900 and completed before Dec. 25, 1901. (March 30, p. 209.)

COCHITI & NORTHWESTERN.—The route for this proposed line is from a point on the Atchison, Topeka & Santa Fe, two miles east of Thornton, N. M., to run northwest 40 miles over the Mesa to the Rio Grande, crossing that river just above the Indian village of Cochiti; thence along Pino Creek and Pino Canyon to the mouth of that canyon at Woodbury, and thence to the mining town of Bland in the Cochiti mining district; also branches to points to be determined later. The road has been surveyed and contracts are to be let about May 1. The maximum grade is 4 per cent.; the minimum, 1 per cent. There is scarcely any curve. Several bridges will be required. (March 30, p. 209.) The officers are given under Elections and Appointments. (Official.)

EAST SIDE.—The city of Olympia, Wash., has granted an ordinance giving this company right of way through certain portions of the city from the Northern Pacific and along Jefferson St., with spurs, switches, etc.

GRAND RAPIDS, HOLLAND & LAKE MICHIGAN RAPID.—It is proposed to begin work immediately on this line from Grand Rapids, Mich., southwest about 35 miles to Holland and thence to Ottawa Beach and Macatawa and Jenison Parks on Lake Michigan, passing through the towns of Grandville, Jenison, Jamestown, Vriesland, Zeeland and Waverly. The work will be done by the company. The officers are given under Elections and Appointments. (Official.)

GREAT NORTHERN.—A contract has been let to Sheppard & Henry of St. Paul, Minn., according to report, for an extension from the present terminus of the Seattle & Northern line at Hamilton, Wash., to run southeast about 75 miles along Sauk Valley to Monte Cristo and thence by a short mountain tunnel to Index on the main line.

GULF, BEAUMONT & KANSAS CITY.—The old Colony Construction Co., of Boston, Mass., is reported to have the contract for extending this line from Logan, Tex., north about 65 miles to San Augustine. (Sept. 29, 1899, p. 719.)

HELENA, TUPELO & DECATUR.—Partial surveys have been made and about 30 miles were graded some time ago on this proposed line from Arkansas City, Ark., northeast through Grenada, Tupelo, Miss., and Moulton, Ala., to Decatur. From Tupelo the line runs through the counties of Franklin, Lawrence and Morgan, Ala., where there are coal, iron and forests of hardwood and pine. There is 40 miles of the western part of the line on the Mississippi River bottom which contains much hardwood timber except at the crossings of other roads. The whole line in Mississippi is through a rich agricultural country which has been cleared, for the most part, only on the uplands. The bottoms are good land and are still covered with dense forests. The company expects to

get funds to resume work some time this year. (March 23, p. 195.) H. C. Medford, of Tupelo, Miss., is Secretary, and E. C. Finley, of Wharton, Tex., Chief Engineer. (Official.)

ILLINOIS CENTRAL.—The company, according to report, is to begin building at once, a viaduct to connect the Omaha Bridge & Terminal Company's line with the Missouri Pacific Belt, giving the I. C. direct access to South Omaha. The cost is said to be about \$100,000.

LOCKPORT & OLCOTT.—This company has been incorporated in New York, with a capital stock of \$200,000, to build a railroad to be operated by electricity or other power from the Erie R.R. at Lockport to run north about 20 miles to Olcott. Among the directors are: Willis Van Horne, Niagara; Henry J. Pierce, Buffalo; John E. Pound, Lockport.

MONTFORT & GATINEAU.—Permission is granted to this company to build an extension from the present terminus near St. Sauveur, to a point on the Great Northern (Canada) near Canut, and thence to the junction with the Jacques Cartier Union Ry., near Montreal, with permission to lease to the Alberta Railway & Coal Co., or to the Canadian Pacific.

MIDVILLE, SWAINSBORO & RED BLUFF.—This company was reincorporated in Georgia, March 30, increasing its capital stock to \$2,392,000. The road now runs from Midville southwest 18 miles to Swainsboro, and it is proposed to extend it northeast about 50 miles to Augusta and southwest about 150 miles to the Florida line in Lowndes and Thomas counties. F. C. Branan of Swainsboro, Ga., is Superintendent.

MINNESOTA & MANITOBA.—The House of Representatives at Washington has passed a bill granting this company right of way through the Red Lake Indian Reservation in Minnesota. The company is incorporated to build the American portion of the Canadian Northern line of Mackenzie & Mann, between Fort Francis and Winnipeg. (April 21, 1899, p. 289.)

MISSOURI, KANSAS & NORTHWESTERN.—Preliminary surveys have been completed, according to report, from Mineral City, Mo., to Joplin. The road is to be extended on to Carthage, Mo. The company was fully organized April 7. (April 6, p. 298.) The officers are given under Elections and Appointments.

NEW YORK CENTRAL & HUDSON RIVER.—A bill is before Mayor Van Wyck of New York City, passed by the Legislature of New York, to straighten the railroad tracks between Kingsbridge and Spuyten Duyvil. It is proposed to run the tracks along the side of the Harlem Ship Canal and that the city bear the cost of the canal shore roadbed and receive in return the old roadbed to be laid out as a street.

NEW YORK, NEW HAVEN & HARTFORD.—Surveys are reported in progress for a line from a point near the Taftville tunnel, to run north along the east bank of the Shetucket River to a point near the village of Versailles, Conn., at what is known as Lovett's crossing, about four miles. This would give a new connection between Willimantic and Hartford.

NORTHERN PACIFIC.—Right of way is being secured, according to report, for the extension from Dayton, Wash., northeast to Covello. (Dec. 29, 1899, p. 902.)

Surveys are reported in progress for a branch from Arlington, Wash., to run east about 30 miles to Darrington.

OTTAWA & DUNDAS.—The Canadian House has passed a bill incorporating this company, with amendment that it be restricted to the use of steam only, and that the telegraph and telephone lines along the route shall be used only by the company.

PENNSYLVANIA.—Work is begun on the new freight cut-off between Newark, N. J., and Jersey City, which, when completed, will do away with the running of coal and freight trains through the city of Newark. (Feb. 16, p. 112.)

The company owns a water front of nearly one-half mile on the western side of New York Bay, near Greenville, N. J., at which place it has under contract a new bulkhead and filling beyond the bulkhead.

PITTSBURGH, BUFFALO & EASTERN.—Under this title it is proposed to build the road heretofore referred to under the Bradford Central. It will extend from Ansonia, Pa., on the Buffalo & Susquehanna, east to Canton, on the Northern Central line of the Pennsylvania, there to connect with the Western extension of the Barclay, which is to be extended to Binghamton, N. Y., in all about 110 miles. (Feb. 2, p. 79.)

POLK COUNTY.—Preliminary surveys are made and contracts are to be let soon for this proposed line through Polk County, N. C., to run through Poors Ford, Columbus Mills and Chimney Rock to Hendersonville. There will be two bridges of 200 ft. each. (March 30, p. 210.) F. M. Stearns, of Cleveland, O., is President. (Official.)

QUEBEC ROADS.—The Canadian Government offers \$5,000 a year for 12 years to any company undertaking to build a railroad from La Belle, the terminus of a branch of the Canada Atlantic, to run northwest to Lake Noninque.

QUEEN ANNE'S.—An extension has been decided upon, according to report, from Queenstown, Md., to run west about 18 miles to Love Point at the mouth of the Chester River, where new wharves and stations will be built.

ROCHESTER & LAKE ONTARIO.—The officers are trying to get permission from the property owners to change this line from steam to electricity. It runs from Rochester, N. Y., to Lake Beach on Irondequoit Bay, 6.05 miles.

ST. MARY'S RIVER.—A bill has been passed granting this company right to build a railroad from Sterling and Lethbridge, N. W. T., to the International boundary line.

SAN ANTONIO & BROWNSVILLE.—H. N. Aubrey, of San Antonio, Tex., President, has filed an application with the Railroad Commission of Texas for authority to issue bonds to the extent of \$18,000 per mile, and stock to the extent of \$1,000 per mile

on the 275 miles of this line from San Antonio south to Brownsville. (Dec. 15, 1899, p. 872.)

SOUTH GEORGIA.—At the annual meeting on March 28 an issue of bonds was authorized for the proposed extension from Quitman, Ga., south toward Tampa, Fla. (March 2, p. 146.)

SOUTHERN PACIFIC.—The company is reported filling in a portion of Mission Bay at San Francisco to add about eight miles of switching.

STILLMORE AIR LINE.—Grading is begun, according to report, on the extension from Swainsboro, Ga., north 19 miles to Wadley, and the company expects to have the line completed by Sept. 1. (June 9, 1899, p. 418.)

SUNSET.—Location was to be completed by April 10 for this recently incorporated line in California, to run from Bakersfield, on the Southern Pacific, southwest 39 miles via Gosford and Lakeside to Sunset. It has not been determined when contracts will be let. The principal office is at Bakersfield. (March 30, p. 210.) The officers are given under Elections and Appointments. (Official.)

TEXAS & PACIFIC.—With reference to the proposed extension from Donaldsonville, La., an officer writes that the company is running a line southeast along Bayou la Fourche. The company also has an option on a short line which the company will buy provided it is decided to build the La Fourche Branch. The extension will be 30 miles long, with approximately a level grade, and will supply shipping facilities to about 50 sugar houses. Decision as to building will probably be reached within two weeks. (March 30, p. 210.)

VERSAILLES & OSGOOD.—This company, with a capital stock of \$70,000, as already noted (March 30, p. 210), was incorporated in Indiana, March 3, to build a railroad from Versailles to Osgood in Ripley County. The incorporators are: Grant Johnson, Alfred H. Beer, Frank S. Jones, Versailles, Ind.; William D. Willson and Robert A. Creigsmile, of Osgood, Ind.

WABASH.—The Directors have authorized a mortgage for \$5,000,000 for the proposed extension from Toledo, O., west about 50 miles to Montpelier, which will give the company a continuous line from Toledo to Chicago. Under the mortgage the company will negotiate the sale of \$4,000,000 40-year bonds to meet the cost of building and to acquire rolling stock.

WEST VIRGINIA CENTRAL & PITTSBURGH.—The company is ready to receive bids for building the Coal & Iron extension from Elkins, W. Va., south 43 miles to the forks of Greenbrier River. Bids are to be opened April 15. C. H. Latrobe, 813 Merchants' Bank Bldg., Baltimore, Md., is Consulting Engineer. (Jan. 26, p. 64.)

WEST VIRGINIA NORTHERN.—Extensive improvements are about completed on this line from Tunnelton, W. Va., to Kingwood, 10.5 miles, including change to standard gage, shortening of curves and reduction of grades.

YELLOW RIVER.—The Alabama section of this road, known as the Florida, Alabama & Northern, is to be extended from Florida northeast 50 miles via Elba to Troy, Ala. The line has been located and the company proposes to build as fast as possible. W. B. Wright, of Pensacola, Fla., is President. (Jan. 6, 1899, p. 16; F., A. & N., Oct. 7, 1898, p. 732.)

GENERAL RAILROAD NEWS.

BALTIMORE & OHIO.—The Board of Directors has adopted the recommendation of the Executive Committee to increase the common stock by \$6,400,000, which is to be offered to holders of common stock at 80 between April 21 and May 7. Ten dollars on each share must be deposited with the subscription, and the remaining \$70 paid on Oct. 1. This new stock will not participate in any dividends that may be declared this year. (March 16, p. 178.)

BIRMINGHAM BELT.—The stockholders will meet at Birmingham, Ala., May 5, to consider the issue of \$1,500,000 bonds to be secured by mortgage on the road and equipment. The company was incorporated in Alabama last year to take over the Highland Avenue & Belt Line of Birmingham, to be operated as a belt and suburban passenger road. (Sept. 15, 1899, p. 650.)

CENTRALIA & CHESTER.—Judge Allen in the U. S. Circuit Court at Springfield, Ill., has entered a decree of foreclosure sale against this property to take place in about 60 days at Sparta, Ill. (Oct. 13, 1899, p. 720.)

CHICAGO, INDIANAPOLIS & LOUISVILLE.—Special Master James M. Winters at Indianapolis, April 4, filed a report in the suit of the Louisville Trust Co. vs. the Louisville, New Albany & Chicago upholding the legality of the reorganization of that property into the new company, the C. I. & L. The foreclosure had been alleged to be a scheme to defraud the general creditors, particularly the holders of the guaranteed bonds of the Richmond, Nicholasville, Irvine & Beattyville. An officer of the reorganized company says that the decision puts at rest every question as to the validity of the reorganization of the company and establishes the title to the property. He also says that the railroad since its organization has been using all its surplus earnings in rehabilitating the road. New rolling stock has been bought, grades reduced and ballasting of 107 miles of road has just been completed. A controlling interest in the Kentucky & Indiana Bridge has also been secured. He says that the road's present earnings are sufficient to pay the interest on its bonds, full dividends on preferred stock and leave a surplus sufficient to pay 6 per cent. on the common. (June 30, 1899, p. 484.)

FITCHBURG.—The stockholders of the Boston & Maine on April 5 voted to ratify the lease of the Fitchburg by a vote of 137,035 to 295. (March 30, p. 210.)

FORT WORTH & DENVER CITY.—The company has sold its telegraph system between Fort Worth, Tex., and Texline, 452 miles, to the Western Union Telegraph Co. for \$150,000.

HOUSTON & TEXAS CENTRAL.—The U. S. Supreme Court has decided in favor of the company

in the suit brought against it by the State of Texas, which involves the validity of payments made in State warrants during the Civil War on account of money borrowed from the school fund for the State. The State courts held that the payments were invalid because the warrants were unconstitutional as having been issued in aid of the Rebellion, but this decision is reversed by the Supreme Court. It involves more than \$1,000,000. (April 6, p. 228.)

HOUSTON EAST & WEST TEXAS.—Negotiations have been concluded for the transfer of this property to the Southern Pacific, which has acquired practically all the stock. The road was formerly controlled by Blair & Co. (March 2, p. 146.)

LOUISVILLE, EVANSVILLE & ST. LOUIS.—Judge Woods, in the U. S. Circuit Court at Indianapolis, Ind., April 7, ordered the foreclosure sale of this property to satisfy the consolidated and first mortgage bonds. To protect the holders of the second mortgage bonds, the Court ordered that the purchaser of the road shall pay into chancery the sum of \$670,000, to be held until the claims of the second mortgage can be adjudicated. W. P. Fishback of Indianapolis was made Special Master, and the upset price is fixed as follows: Evansville Branch, \$500,000; Indiana Division, \$1,500,000; Evansville & Indiana Division, \$2,000,000; Illinois Division, \$1,500,000; general mortgage bonds, \$20,000. The Court passed approval on the work of Receiver Jarvis. It has developed, according to report, that practically all the consolidated and first mortgage bonds are held by J. P. Morgan & Co., and that the intention is to bid the road in for the Southern. (Nov. 17, 1899, p. 802.)

MOBILE & OHIO.—At the annual meeting of the St. Louis & Cairo last week, it was voted to surrender the present lease and to merge the property with the M. & O. under the terms recently given in this column. (March 23, p. 194.)

MOBILE, JACKSON & KANSAS CITY.—A supplemental mortgage for \$4,000,000 has been filed by the company which limits the issue to \$20,000 per mile, and decreases the period during which defaults must occur before foreclosure can be begun from one year to six months. (March 9, p. 162.)

MONONGAHELA RIVER.—The Baltimore & Ohio has assumed control of this property from Fairmont, W. Va., to Clarksburg, 31.2 miles, and it is to be operated as the Monongahela River Division. (Jan. 5, p. 14.)

NEW YORK & HARLEM.—The principal of \$12,000,000 consolidated mortgage 7 per cent. bonds, maturing May 1, will be paid at the office of J. P. Morgan & Co., New York.

NORTHERN CENTRAL.—The Board of Directors has accepted the proposition to offer to stockholders of record April 10 the right to subscribe, between April 16 and May 10, to \$2,500,000 new stock at \$70 per share in amounts equal to one-third of their holdings. Full payment is to be made between June 11 and 20. The proceeds are to be used to take up a portion of the bonds maturing on April 1 and July 1. (April 6, p. 228.)

OHIO MIDLAND.—This company has been incorporated in Ohio, with a capital stock of \$30,000, as successor to the Newark, Somerset & Straitsville, which was sold under foreclosure Feb. 19, to the Baltimore & Ohio. The incorporators are: Judson Harmon, Edward Colston, A. W. Goldsmith, George Hoadley, Jr., and Oscar Stoehr.

PANAMA.—The fiftieth annual report of the Panama R.R. Co. to Dec. 31 was issued last week. The total earnings of the railroad and the steamship line were \$2,195,042, being an increase of \$52,161 over 1898. The net income was \$295,232, the increase over 1898 having been \$28,485. The General Manager points out that economies which would otherwise have been realized do not appear in this report because it became necessary to raise the wages of common labor 45 cents silver per day on the Isthmus; yet by an increase in the tonnage carried the cost per ton has been materially lessened. The improvements of track and roadbed have now been so far completed that the road may be maintained for some years with a minimum of expenditure. The rolling stock and floating equipment now require similar attention which will, however, involve only a comparatively small sum.

PEORIA, DECATUR & EVANSVILLE.—Judge Allen in the Federal Court at Springfield, Ill., has confirmed the sale of this property made on Feb. 6 to the Central Trust Co., New York, representing the bondholders. (Feb. 9, p. 96.)

The dissenting second mortgage bondholders and stockholders have appealed from the decree of foreclosure and this appeal will be heard in June. It is stated that no reorganization can be effected before a decision is made.

RAQUETTE LAKE.—A bill is before the Governor of New York for approval, to permit this road to change its motive power to steam generated by oil. The road was built last year through the forests of the Adirondacks from Clearwater to Raquette Lake, 19 miles.

ST. LOUIS & SAN FRANCISCO.—Fourteen Fort Smith & Van Buren Bridge Co. first mortgage 6 per cent. bonds have been called for redemption at 105 and interest on Oct. 1, at the Mercantile Trust Co., New York. (Feb. 9, p. 96.)

ST. LOUIS SOUTHWESTERN.—The Directors on April 5 declared a payment of \$23.22 on each coupon of the \$9,000,000 second mortgage bonds outstanding out of the earnings of the six months ended Dec. 31 last. This payment, with the \$16.78 made on Jan. 1, completes the annual payment of 4 per cent. to which the bonds are entitled. (Nov. 3, 1899, p. 770.)

THIRD AVENUE (N. Y.).—Kuhn, Loeb & Co., New York, have bought \$35,000,000 of 4 per cent. 100-year first consolidated mortgage bonds of the Third Avenue, guaranteed principal and interest by the Metropolitan Street Ry. Co. The issue is part of an authorization of \$50,000,000, of which \$15,000,000 is reserved to retire prior liens, and is secured by a mortgage on all the property of the company. The price is said to be about par. This is apparently a long step in the progress of reorganization. (April 6, p. 298.)